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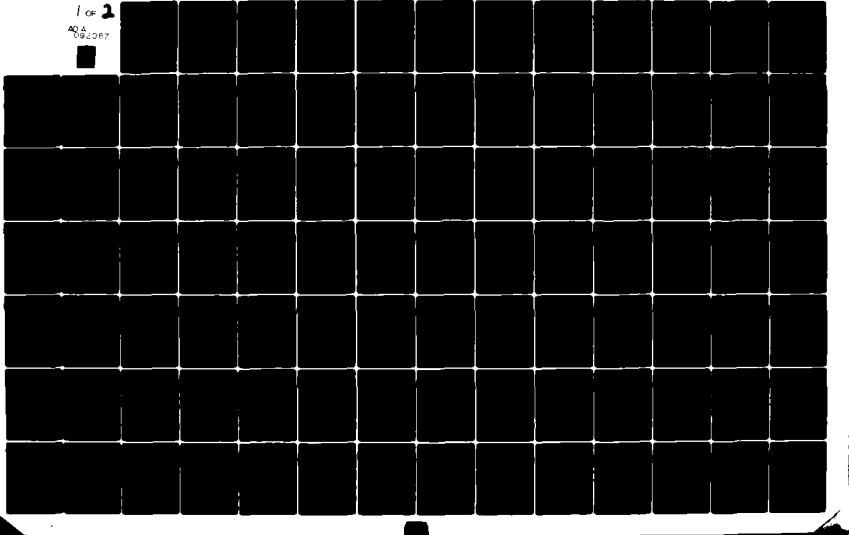

LEVEL II

DIVISION REAL TIME APPLICATIONS (DIVRAS) SOFTWARE FUNCTIONAL DESCRIPTION

3 AUGUST 1977

TARGET DATA ROUTING AND COMMANDER'S DISPLAY APPLICATIONS

Prepared for the
Battlefield Systems Integration Directorate
USA DARCOM

DIVISION REAL TIME APPLICATIONS REPORT

(DIVRAS)

SOFTWARE FUNCTIONAL DESCRIPTION

Submitted to:

Headquarters USADARCOM
Directorate for Battlefield Systems Integration
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Federal Systems Division
INTERNATIONAL BUSINESS MACHINES CORPORATION
1701 North Fort Myer Drive
Arlington, VA 22209

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SECTION 1. SCOPE

1.1 IDENTIFICATION

This document contains functional requirements for two application areas and their external interfaces that are candidates for inclusion in the Army's Tactical Operations System (TOS) at division level. The Targeting and Maneuver Applications comprise the Division Real-Time Applications (DIVRAS) developed under auspices of DARCOM Battlefield Systems Integration staff during the period January 3 through August 3, 1977.

1.2 FUNCTIONAL SUMMARY

The DIVRAS functional requirements are specified in subsequent portions of this document in terms of these three areas:

- External Interfaces
- Targeting Application
- Maneuver Application

Further definition of software functions necessary to implement these applications is provided in the form of detailed descriptions of three major subsystems:

- Communications Processing
- Data Base Management
- Graphics Processing

The application functions provide a user oriented definition of the processes necessary to accomplish the real-time targeting and

maneuver display activities; the software support functions offer representative processing capabilities necessary to support the applications.

The intent of this document is to define the real-time targeting and maneuver applications sufficiently to enable decision by cognizant Army agencies on whether to include these capabilities in the TOS Required Operational Capability (ROC) scheduled for approval in third quarter of CY77, and make preliminary implementation decisions if necessary. Since these represent two of many potential applications to be included in TOS, it has been assumed in this document that DIVRAS has direct access to TOS ENSIT/FRENSIT data. The precise nature of that interface has not been detailed herein, in order to allow future Army determination of an implementation of that interface consistent with tactical doctrine.

This specification focuses on the two specific software application areas and their external interfaces. Other overall hardware and/or system related requirements (e.g., quality assurance provisions, diagnostics, personnel and training, etc.) are not part of this effort. In this approach this document is not intended to restrict or pre-judge the eventual hardware implementation to support the applications.

SECTION 2. APPLICABLE DOCUMENTS

The following documents were utilized as references in the development of particular aspects of the functional requirements described herein:

- TOS^2 Staff User Manual, January 1976
- Concept of Operation and Employment for the Field Artillery Equipped With TACFIRE
- Artillery Target Intelligence - Reference Note, July 1976
- Design Description Document for LP Message Skeletons Addendum for TACFIRE - 23 April 1976
- Current Operational Concept - SOTAS
- Military Systems for Tactical Operations (Reference Handbook) MITRE, April 1977 for DARCOM/BSI
- Technical Interface Concept for Target Acquisition and Control Systems - DARCOM/BSI
- U. S. Army Field Manual #100-5 - July 1976
- Intelligence Preparation of the Battlefield - TC30 Techniques of Tactical Intelligence Analysis - March 1976 (Draft) - USAICS, Ft. Huachuca
- Specification for Interactive Graphic Capability for ASSIST AN/GYQ-21(V) - 1 February 1977
- Division Real Time Applications Specification (DIVRAS) Report - 3 August 1977

SECTION 3. REQUIREMENTS

MAJOR FUNCTIONS

This section will specify software functions necessary to perform the DIVRAS Targeting and Maneuver Applications. Figure 3-1 illustrates how the functions required by these two applications are allocated among three major software subsystems--Communications Processing, Data Base Management, and Graphics Processing. Targeting and maneuver data in the form of message traffic feeds into DIVRAS via the Communications Processing Subsystem. Communications control and initial message processing for routing purposes is accomplished there in addition to logging and data buffering before transfer. The Data Base Management Subsystem performs furtner data validation, formatting, and logical processing before entering the data into file, forwarding alert messages to the targeting/maneuver analyst where required. It further handles all analyst interactions with the data base--queries, searches, updates, outputs--providing responses directly to alphanumeric terminals, or through the Graphics Processing Subsystem to the graphics displays. The Graphics Processing Subsystem provides functions necessary to generate and manage data presented as images, providing capabilities to both the targeting and maneuver analyst to graphically portray real-time data in a geographic perspective. By means of these major functions, real-time targeting and maneuver display activities can be performed.

Primary DIVRAS functions (including the necessary input data and resulting outputs) are specified in Section 3.1 - Detailed Functional Requirements. These sections describe in user-oriented terms the minimum functions essential to adequate performance of the two applications.

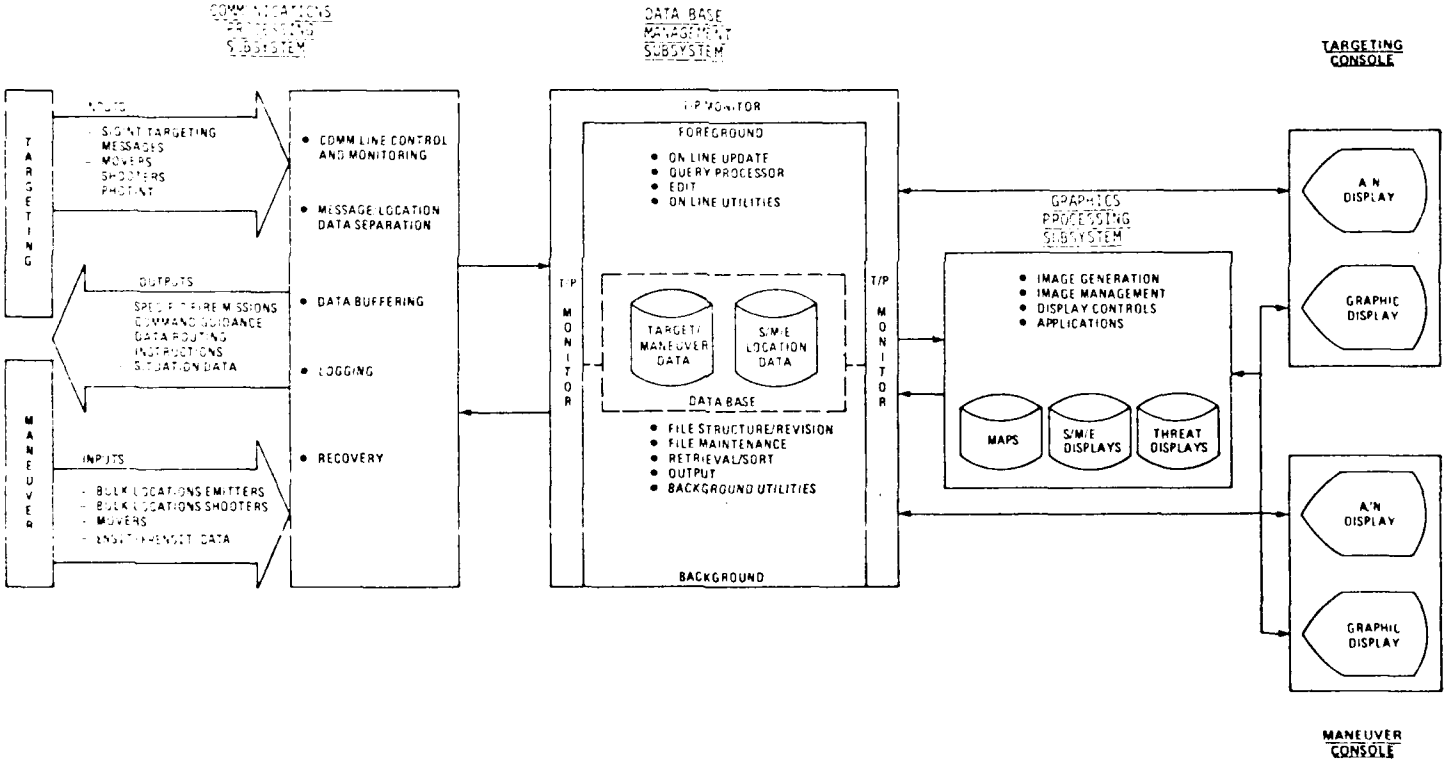


FIGURE 3-1. DIVRAD MAJOR FUNCTIONS

These requirements have been further definitized in Section 3.2 - System Support Software by identifying requirements for a representative approach, allocating software functions across the three major software subsystems, and describing the detailed software functions within each subsystem necessary to fulfill the requirements defined in Section 3.1. Recognizing that the DIVRAS functions may be only a subset of the applications required for Division Command and Control, the allocation of functions across software subsystems and the specific lementation approaches within each subsystem are intended to provide further explanation/definitization of the primary requirements, not to specify an implementation approach. Any approach offering at least equivalent function and meeting the requirements defined in Section 3.1 will be sufficient for the DIVRAS applications.

EQUIPMENT INTERFACES

The DIVRAS software, in order to be responsive to application requirements, should operate on a general purpose hardware processing configuration which will permit rapid response to all operational and external communication functions in an on-line (foreground) mode, as well as permit background mode task initiation and execution. The operational functions will include extensive on-line use of flexible data base management/communication and graphics software. Figure 3-2 portrays basic hardware system capabilities with which the software must interface.

Figure 3-2 indicates two major hardware subsystems: the communications processing subsystem and the data base management/display processing subsystem. This separation is desired to permit maximum evolution and responsiveness for each of the separate parts of the system. With this approach, as the communication protocols, formats, rates, and sensor ground station functional tradeoffs evolve, it is intended that the

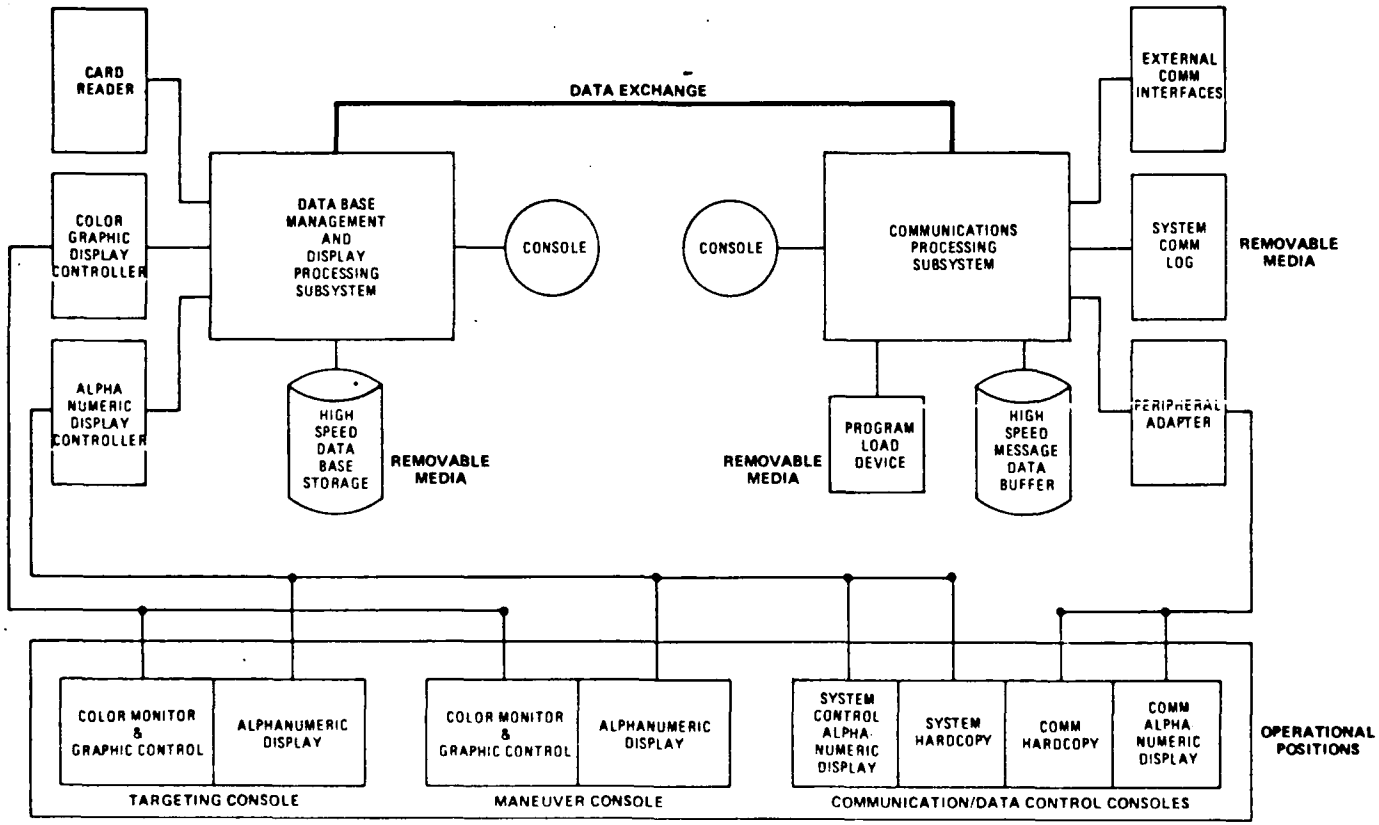


FIGURE 3-2. BASIC HARDWARE CONFIGURATION

impact to the DIVRAS communication processing software can be better contained and managed. In a similar manner, as the DIVRAS display and data control applications evolve, they can likewise be managed and contained. The data base management and the graphics display are included in one subsystem because of their inherently integrated nature. The fundamental output of the data management system software is display (both alphanumeric and graphic) of the qualified information. The graphic and alphanumeric processing software presents data automatically or initiated by an operator which in effect represents data that has been logically managed, qualified, and processed by the data management software.

The data management and display subsystem should contain appropriate hardware and supporting software to accommodate the functions of initial data base and program loading as well as software control table/data base maintenance task initiation.

The communication processing subsystem should contain a program load device (a removable media with an off line preparation mode, such as a diskette with key to disk capability is desirable) and an alphanumeric display terminal to support the functions of program initialization and communication configuration control.

The communications processing subsystem performs the tasks of:

- input and output communications processing to the external communication interfaces
- separation and buffering of the message data and the bulk message detection data (the former supports the targeting application while both support the maneuver application)

- system log management
- short period outage continuity (recovery of information preserved on the system log)

The data base management and display processing subsystem performs the tasks of:

- message to data base conversion processing (including translation and inference)
- data basing for the targeting and maneuver applications
- display processing (alphanumeric as well as integrated targeting and maneuver graphics)
- interactive terminal support (including formatting for interoperability)
- system data control, error monitoring and recovery.

PROGRAM INTERFACES

In the absence of other applications, the major DIVRAS program interface will be with the operating system software of the chosen implementation approach.

In specifying the software functions described herein, and in consonance with the hardware assumptions, the following characteristics have been assumed about the operating system that will support DIVRAS:

1. It will be capable of controlling multiprogramming operations --multiple concurrent tasks on both on-line (foreground) and background task levels.

2. Access methods and device handling operations supporting all required devices indicated in Figure 3-2 will be provided.

3. The O/S will provide full development support (compilers, assemblers, library support) plus utilities software.

3.1 DETAILED FUNCTIONAL REQUIREMENTS

3.1.1 External Interfaces

3.1.1.1 Interfaces

The DIVRAS applications shall be capable of supporting interfaces to the generic tactical nodes indicated in Figure 3.1.1-1.

These applications shall support direct or indirect interface to the following seven sensor data sources:

- TACFIRE
- SOTAS
- TRAILBLAZER
- TEAM PACK
- GUARDRAIL
- QUICKLOOK
- MAGIIC OV-1

The specific input and output message types and message rate requirements for these interfaces is specified in the following paragraphs.

3.1.1.2 Inputs

3.1.1.2.1 Input Message Types

The DIVRAS applications shall support processing of all input message types indicated in Figure 3.1.1-2 (specific formats are indicated in Appendix I).

The DIVRAS applications shall support direct processing of existing TACFIRE formats as inputs to include the following:

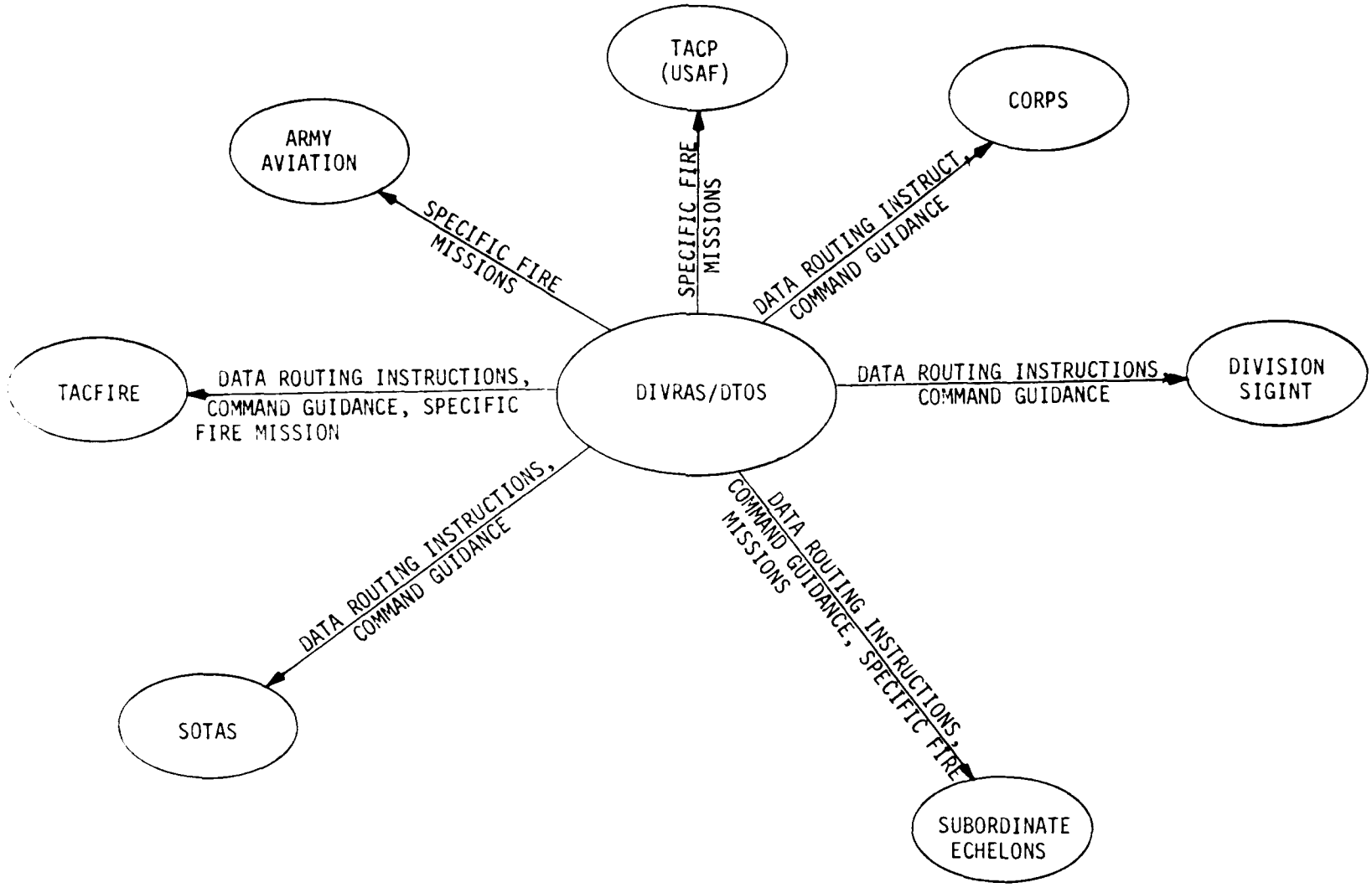


FIGURE 3.1.1-1. DIVRAS PRIMARY EXTERNAL OUTPUT MESSAGE INTERFACES

EXTERNAL NODE	MESSAGE TYPE INDICATOR	USE	FORMAT KEY (APPENDIX I)	INPUT TO DIVRAS	OUTPUT FROM DIVRAS
SOTAS	SO1	QUERY RESPONSE	A	X	
	SO2	TRACK REPORT	A	X	
	SO3	TRACK LOSS REPORT	A	X	
	SO4	SPECIFIC TRACK REPORT (REQUESTED TRACK UPDATE)	A	X	
	SO5	TRACK LOSS REPORT (SPECIFIC TRACK)	A	X	
	SO6	INFERRED TARGET REPORT	A	X	
	SO10	QUERY	B		X
	SO12	STANDING TRACK REQUEST	B		X
	SO14	SPECIFIC TRACK REQUEST	B		X
	SO20	COMMAND GUIDANCE	C		X
DIVISION SIGINT SOURCES	CA1	QUERY RESPONSE	D	X	
	CA2	ANALYZED EMITTER TARGET REPORT, ENEMY ACTIVITY OR CONCENTRATION	D	X	
	CA3	ANALYZED EMITTER TARGET REPORT, COMMAND POST/ ARTILLERY	D	X	
	CA4	ANALYZED EMITTER TARGET REPORT, RADAR	D	X	
	CA5	ANALYZED EMITTER TARGET REPORT, SUPPLY/COMBAT SERVICES	D	X	
	CA6	TIME GROUPED, DETECTED EMITTER LOCATIONS	E	X	
	CA10	QUERY	B		X
	CA12	STANDING REQUEST FOR ANALYZED EMITTER TARGET REPORTS	B		X
	CA20	COMMAND GUIDANCE	C		X
DIVISION ARTILLERY	ATI/TGR (DA4A)	SHOOTER TARGET REPORT	F	X	
	ATI/TGR (DA4B)	ENEMY ACTIVITY/CONCENTRATION (NON-GSR DETECTED)	F	X	
	ATI/TGR (DA4C)	ENEMY ACTIVITY/CONCENTRATION (GSR DETECTED)	F	X	
	DA4D	TIME GROUPED, DETECTED MOVER/SHOOTER LOCATIONS	E	X	
	ATI/QUERY	QUERY RESPONSE	G	X	
	ATI/MFR	MISSION FIRED REPORTS	H	X	
	FM/REAF	MISSION REQUEST FROM TACFIRE (ADDITIONAL FIRE OR OUT OF REACH)	I	X	
	PTA	RESPONSE TO PRELIMINARY TARGET ANALYSIS REQUEST	J	X	
	FM	MISSION REQUEST TO TACFIRE	K		X
	FM/PTA	PRELIMINARY TARGET ANALYSIS REQUEST	L		X
	ATI/SRI	STANDING REQUEST FOR SELECTED ATI TARGET REPORTS	M		X
	ATI/QUERY	QUERY	N		X
	SPRT AND FSE	COMMAND GUIDANCE	P		X
CORPS (OTHER EXCHANGES UTILIZE NORMAL INTERFACES BETWEEN CORPS/DIV INCLUDING CORPS/DIV TOS INTERFACE)	CO4A	ENEMY FORCE CONCENTRATION PHOTINT REPORT	D	X	
	CO4B	ANALYZED EMITTER TARGET REPORT, ENEMY FORCE CONCENTRATION	D	X	
	CO5A	ENEMY CP/ARTY PHOTINT REPORT	D	X	
	CO5B	ANALYZED EMITTER TARGET REPORT, ENEMY CP/ARTY	D	X	
	CO6A	ENEMY RADAR/MISSILE PHOTINT REPORT	D	X	
	CO6B	ANALYZED EMITTER TARGET REPORT, RADAR	D	X	
	CO7A	ENEMY SUPPLY/COMBAT SERVICES PHOTINT REPORT	D	X	
	CO7B	ANALYZED EMITTER TARGET REPORT, ENEMY SUPPLY/COMBAT SERVICES	D	X	
	COR	TIME GROUPED, DETECTED EMITTER LOCATIONS	E	X	
SUBORDINATE ECHELONS (*These include query, SRI, and responses as appropriate)	ESD*	ENEMY SITUATION DATA (ENEMY/TARGET ACTIVITY)	Q	X	*
	EUS*	ENEMY UNIT SITUATION/LOCATION	R	X	*
	UTO*	FRIENDLY UNIT	S	X	*
	UTI*	FRIENDLY UNIT	T	X	*
	UTD*	FRIENDLY UNIT DISPOSITION	U	X	*
	UAA*	FRIENDLY UNIT STATUS	V	X	*

FIGURE 3.1.1-7. DIVRAS EXTERNAL INTERFACE MESSAGE TYPES

- ATI/TGR
- ATI/Query
- ATI/MFR
- FM/RFAF
- PTA

The DIVRAS applications shall support direct processing of existing TOS[2] formats as inputs, to include the following:

- ESD
- EUS
- UTO
- UTF
- UTD
- UAA

The DIVRAS applications shall support direct processing of input messages from the SOTAS Ground Station, Division SIGINT Sources, and the Corps to accommodate the following:

- Response to queries
- Analyzed target intelligence data
- Specified target or track updates

The DIVRAS applications shall support direct processing of time-grouped detections of Shooter, Mover, and Emitter data from the following sources:

- TACFIRE
- Division SIGINT Sources
- Corps SIGINT Sources

3.1.1.2.2 Input Message Rates

The DIVRAS applications shall support direct processing of analyzed Target Intelligence Message types identified in paragraph 3.1.1.2.1 in accordance with the minimum rates specified below:

Source Interface	Target Category	Peak Hour Messages
TACFIRE	Mover	21
TACFIRE	Shooter	153
SOTAS	Mover	66
Division ELINT (TEAM PACK)	Radar	7
*Division COMINT (TRAILBLAZER)		40
Corps ELINT (QUICKLOOK)	Radar	15
*Corps COMINT (GUARDRAIL)		47
Corps All Source		150

The DIVRAS applications shall support direct processing of time-group detections of shooters, movers, and emitters at a maximum of five minute intervals. The capability shall be provided to accommodate at each five minute interval the minimum number of detection locations as specified below:

Source Interface	Target Category	Peak Load Detections (5 Minutes)
TACFIRE	Mover	11
TACFIRE	Shooter	30
Division COMINT (TRAILBLAZER)	Emitters	83
Corps COMINT (GUARDRAIL)	Emitters	55

* These input messages will be provided via the Division or Corps All Source Interface

(More detailed data and rationale for data rates is provided in Appendix IV.)

3.1.1.3 Interface Processing

In the process of receiving and outputting data from the specified interfaces the DIVRAS applications shall provide two general purpose functions to accommodate the multiple interfaces as well as the analyst who utilizes the applications. These functions are identified as Translation and Inference.

3.1.1.3.1 Translation

The DIVRAS applications shall be capable of translating all data elements in all input messages into a common internal set of data elements utilized for internal application processing.

The DIVRAS applications shall be capable of translating an analyst oriented set of English language terms into a common set of data elements utilized for internal application processing.

The DIVRAS applications shall be capable of translating all common internal data elements into the corresponding data elements used in the external interface output messages.

The DIVRAS applications shall be capable of translating all common internal data elements into the corresponding analyst-oriented set of English language terms.

The translation table identifying the correspondence between internal data elements and external interface date elements or English

language terms shall be changeable and can be added to by background processing methods up to a maximum of 2000 items.

3.1.1.3.2 Inference

The DIVRAS applications shall be capable of inferring from logical processing of multiple fields in any of the input messages the following internal data fields when such data is not provided by the input message:

Target Category	Method of Detection
Target Worth	Target Permanence
Location Error	

The DIVRAS applications shall update the processed and data based version of the input message with the inferred values.

The logical combination of data elements utilized to determine inferred values shall be changeable by table entry change using background processing methods.

(More detailed examples of Inference tables are provided in Appendix III.)

3.1.1.4 Outputs

The DIVRAS applications shall support generation and formatting of all output message type indicated in Figure 3.1.1-2 (specific formats are indicated in Appendix I).

The DIVRAS applications shall support direct generation and formatting of existing TACFIRE formats, as outputs, to include the following:

FM (or ATI/CDR)
FM/PTA
ATI/SRI
ATI/Query
SPRT or FSE

The DIVRAS applications shall support direct generation and formatting of output messages to the SOTAS Ground Station, Division SIGINT Sources, and to Corps to accommodate the following:

- Standing Request for Information
- Provide Command Guidance
- Query the External Interface

The automated release of the output message shall be subject to the targeting or maneuver analyst concurrence through action at an interactive terminal.

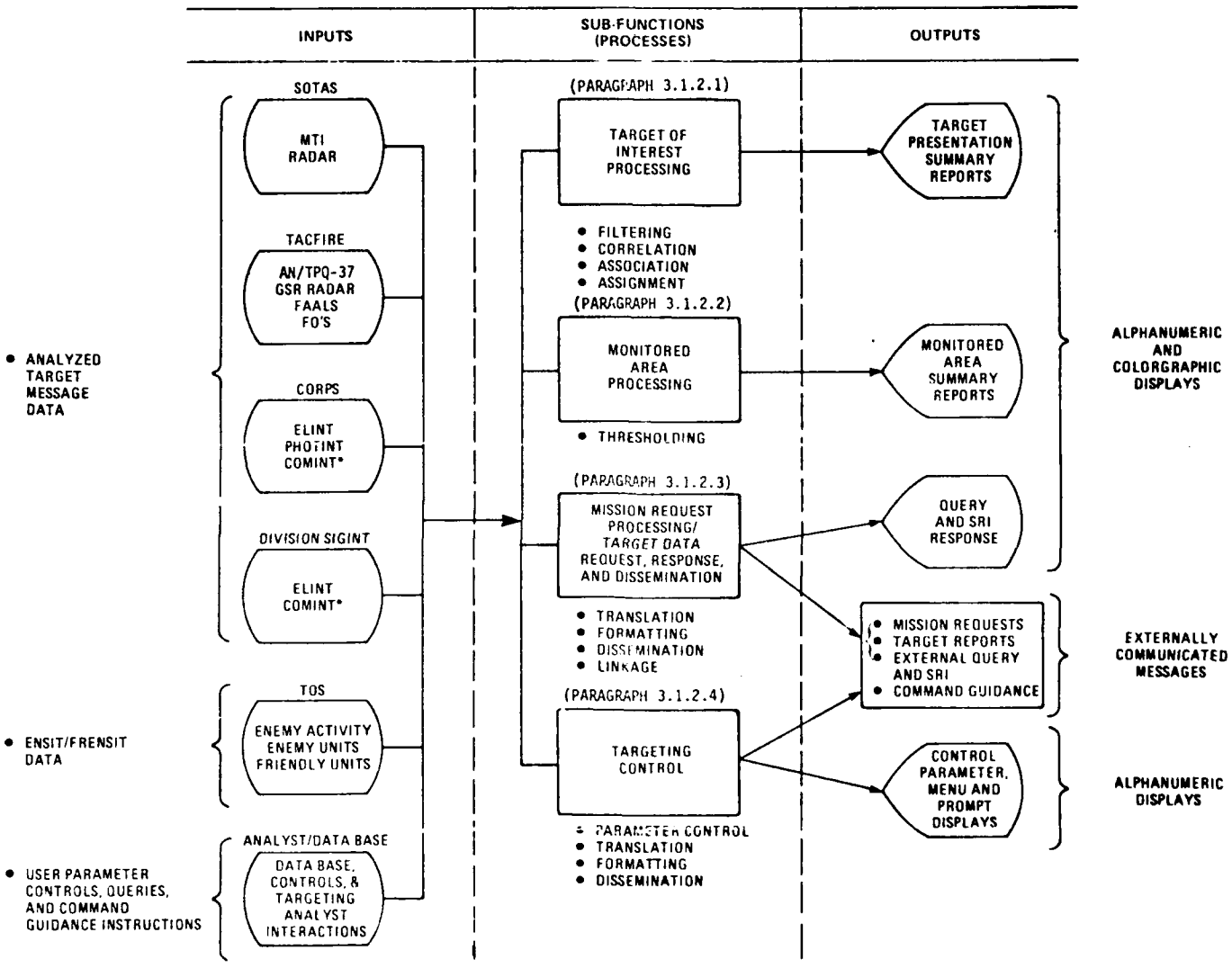
3.1.2 Targeting Application

The objective of the targeting application within the Division Real Time Application System (DIVRAS) is to enhance the DTOC process of weapon assignment against real time targets of worth in a dynamic battle environment within the division echelon.

Figure 3.1.2-1 presents an overview of the targeting application in terms of basic inputs, sub-functions (processes), and outputs. The targeting application shall accept real time targeting messages from four major interfacing nodes as well as enemy activity, enemy unit and friendly unit data from the Tactical Operations System (TOS) ENSIT, and FRENSIT Data Bases.

The targeting application shall also accept as input the on-line user commands, changeable parameter controls and queries necessary to control the total targeting application as well as respond to the analyst information needs, both from the local DIVRAS data base as well as interoperating with the other interfacing systems in such a fashion as to permit query, standing requests for information, target data routing and dissemination.

All target message data, as defined in paragraph 3.1.1, shall undergo translation and inference processing and shall update the DIVRAS targeting and maneuver application data base. The data base update function, including the translation and inference capabilities, are defined in paragraph 3.2.2.



*MUST INTERFACE AFTER ALL SOURCE SANITIZATION

Figure 3.1.2-1. TARGETING APPLICATION OVERVIEW

3.1.2.1 Target of Interest Processing Subfunction

Figure 3.1.2-2 indicates the inputs, processes and outputs of the target of interest processing subfunction.

This subfunction shall automatically process all incoming target or enemy activity message data (which has not been already directly reported by the sensor system to a weapon system) to determine if the target or activity is of current interest to the targeting analyst.

- Current interest shall be defined by a targeting filter table.

- The determination of current interest shall be made on the incoming target or activity message only after translation and inference processing have occurred.

If the target is of interest, the correlation, association and assignment processing steps shall automatically occur; display presentations shall automatically be prepared and the analyst shall be notified of a new target of interest entry into the target of interest work queue without disruption to his current work activity.

If the target or activity is not of interest, no further target of interest processing steps shall occur.

Whether or not the target or activity is determined to be of interest, the input message shall update the targeting/maneuver data base after translation and inference processing have occurred (see paragraph 3.2.2).

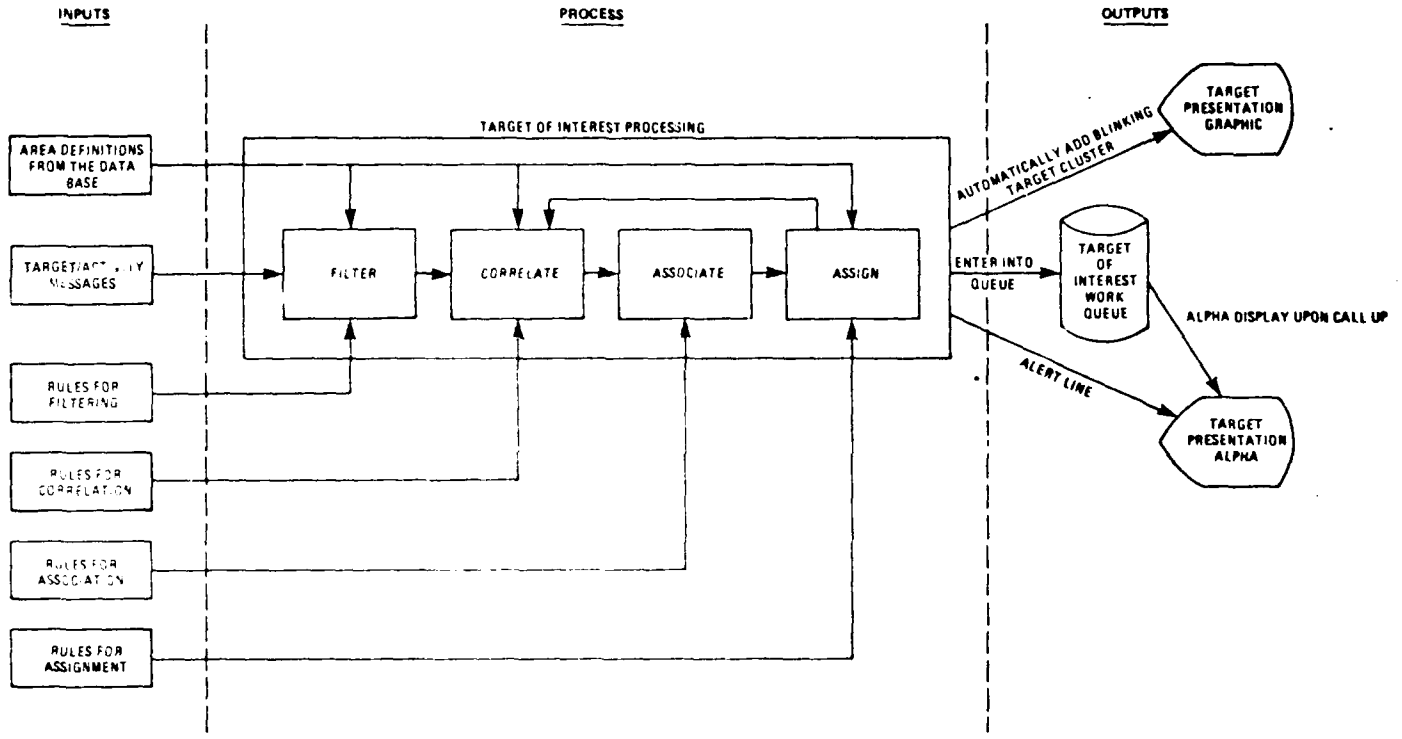


FIGURE 3.1.2-2. TARGET OF INTEREST PROCESSING

The time to process a target of interest, from the time processing is initiated on that target until the alert line to the analyst is displayed, shall not exceed 15 seconds on the average and shall not exceed 30 seconds for 80 percent of all targets which result in a target of interest display. This time shall exclude any communications processing and queuing.

In order to implement the algorithms stated below, the system shall be capable of supporting logical combination on any storable data element in any boolean or arithmetic manner (and's, or's, between limits greater/less than and literal search).

3.1.2.1.1 Filter Algorithm

The target filtering process shall permit the system to automatically determine whether further target of interest processing on an incoming message is required.

The target filtering algorithm shall be specified by a table whose rows are all of the possible targeting or enemy activity message types and whose columns are selected message data elements.

- The column elements of any row shall be logically combinable to form a logical equation for that row which shall then be used as the filter for determining interest for that row (message type).

Figure 3.1.2-3 indicates the filter algorithm.

- The actual criteria values (X's) shall be changeable by either analyst mode control (see paragraph 3.1.2.4) or a table maintenance processing routine initiated as a background task to the on-line system.

REPORT SOURCE	REPORT DESCRIPTION	REPORT TYPE	LOGICALLY "ANDED" CRITERIA								ENEMY UNIT TYPE
			AGE (MINUTES)	AREA	TARGET CATEGORY	TARGET WORTH	LOCATION ERROR	ENGAGE STATUS	CONFIRM STATUS	(OR)	
TACFIRE	SHOOTER REPORT	DA4A	X	X	X	X	X	X	X		
TACFIRE	• NON GSR ENEMY ACTIVITY CONCENTRATION	DA4B	X	X	X	X	X	X			
TACFIRE	• GSR ENEMY ACTIVITY CONCENTRATION	DA4C	X	X	X	X	X	X			
SOTAS	• TRACK REPORT (HIGH INTEREST)	SO2	X	X	X	X	X				
SOTAS	• TRACK LOSS REPORT	SO3	X	X	X	X	X				
SOTAS	• SPECIFIC TRACK REPORT	SO4	X	X	X	X	X				
SOTAS	• TRACK LOSS REPORT (SPECIFIC TRACK)	SO5	X	X	X	X	X				
SOTAS	• INFERRED CP ASSEMBLY AREA, POL ETC	SO6	X	X	X	X	X				
DIV SIGINT	• ENEMY ACTIVITY CONCENT EMITTER RPT	CA2	X	X	X	X	X				
DIV SIGINT	• ENEMY CP ARTY EMITTER REPORT	CA3	X	X	X	X	X				
DIV SIGINT	• ENEMY RADAR EMITTER REPORT	CA4	X	X	X	X	X				
DIV SIGINT	• ENEMY SUPPLY DEPOT CS SIGINT REPORT	CA5	X	X	X	X	X				
CORPS	• ENEMY FORCE CONCENTRATION PHOTINT RPT	CO4A	X	X	X	X	X				
CORPS	• ENEMY FORCE CONCENTRATION SIGINT REPORT	CO4B	X	X	X	X	X				
CORPS	• ENEMY CP ARTY PHOTINT REPORT	CO5A	X	X	X	X	X				
CORPS	• ENEMY CP ARTY EMITTER REPORT	CO5B	X	X	X	X	X				
CORPS	• ENEMY RADAR MISSILE PHOTINT REPORT	CO6A	X	X	X	X	X				
CORPS	• ENEMY RADAR SIGINT REPORT	CO6B	X	X	X	X	X				
CORPS	• ENEMY SUPPLY/DEPOT/CS PHOTINT REPORT	CO7A	X	X	X	X	X				
CORPS	• ENEMY SUPPLY/DEPOT/CS SIGINT REPORT	CO7B	X	X	X	X	X				
TROOPS IN CONTACT	• ENEMY SITUATION DATA	ESDA	X	X	X	X	X				X

FIGURE 3.1.2-3. FILTER ALGORITHM

- The system shall additionally provide the targeting analyst the ability to change the area definitions on-line.

3.1.2.1.2 Correlation Algorithm

For each incoming target or activity report which passes the filter algorithm, the system shall automatically perform correlation processing to assess the key attributes of target worth, target accuracy (location error) and target permanence and attempt to automatically make a fire mission recommendation.

Correlation processing shall be based upon:

- the incoming message data (as translated and inferred),
- other messages already in the targeting data base,
- selected rules of engagement currently reflected within the system.

Figure 3.1.2-4 indicates the correlation algorithm in matrix form. It shall be possible to add/delete correlation situations (rows) to this table in an off-line manner to adapt it to a specific tactical scenario, echelon, or target acquisition sensor mix.

- The specific values such as specified number of meters, or specified worth values, shall be changeable by either analyst mode control (see paragraph 3.1.2.4) or a table maintenance processing routine initiated as a background task to the on-line system.

- The specified named polygon definitions in the table shall be taken from the named polygon definitions contained in the control (geometry) record portion of the targeting data base and as such shall be changeable on-line.

CORRELATION SITUATION (CORRELATION PAIRS)	MESSAGE TYPES TO BE TESTED	INCOMING MESSAGE TEST – LOGICALLY "ANDED" CRITERIA –							LOC CONSTRAINT		TIME CONSTRAINT		DATA BASE CORRELATION TEST – LOGICALLY "ANDED" CRITERIA –					
		TARGET CATEGORY	METHOD OF DETECTION	TGT WORTH	LOC ERROR	TFIRE ADDRESSABLE	PERM						AGENCY	TARGET CATEGORY	METHOD OF DETECTION	TGT WORTH	LOC ERROR	ENEMY UNIT TYPE
• MOVEMENT THROUGH A SPECIFIC TARGETED LOCATION	DA&C (SR S04 (SPECIFIC TRACK) S02 (TRACK)	ENEMY CONCENTRATION	MTIR	1					1									
• OCCUPIED ASSEMBLY OR FORCE CONCENTRATION AREA (MOVER PHOTINT)	S03 SOS (TRACK LOSS	TRACK LOSS	MTIR	1					2		1			ASSEMBLY AREA	PHOTINT			
• OCCUPIED ASSEMBLY OR FORCE CONCENTRATION AREA (MOVER PHOTINT)	S03 SOS (TRACK LOSS	TRACK LOSS	MTIR	1					2		1			ASSEMBLY AREA	INTERCEPT OR COMMINT OF		1	
• OCCUPIED ASSEMBLY OR FORCE CONCENTRATION AREA PHOTINT MOVER	S04A PHOTINT	ASSEMBLY AREA	PHOTINT					AND	2	AND	1	AND		TRACK LOSS	MTIR	1		
• OCCUPIED ASSEMBLY OR FORCE CONCENTRATION AREA INFERRED MOVER ACTIVITY	SOS INFERRED ASSEMBLY AREA	ASSEMBLY AREA	MTIR						2		1			TRACK LOSS	MTIR	2		
• CP/C2 ESTABLISHMENT	SOS INFERRED CP	COMMINT OF	MTIR						2		1			CP/C2	INTERCEPT OR COMMINT OF	1	1	
• SUPPLY/COMBAT SERVICES ESTABLISHMENT	SOS INFERRED SUPPLY OR CS AREA)	ELINT	MTIR						2		1			SUPPLY/ COMBAT SERVICES	INTERCEPT OR COMMINT OF			

LEGEND

LOCATION ERROR

1. EQUAL TO OR LESS THAN A SPECIFIED NUMBER OF METERS

JOINT LOCATION CONSTRAINT

1. WITHIN NUMBER OR WITHIN A SPECIFIED NAMED POLYGON
2. [illegible] WHERE R IS A SPECIFIED NUMBER FOR EACH TIME DETERMINED FOR EACH CASE IN PLEXXYYY THE LEAST VALUE OF XX OR RS 100 M

TARGET WORTH

1. EQUAL TO OR HAS A SPECIFIED WORTH NUMBER
2. FOR ALL RECORDS THAT QUALIFY ON ALL OTHER SPECIFIED PARAMETERS THE SUM OF THE QTY FIELD MUST EXCEED A SPECIFIED THRESHOLD

JOINT TIME CONSTRAINT

1. (CURRENT TIME, – EVENT TIME,) ≤ T WHERE T IS A SPECIFIED NUMBER OF MINUTES

PERMANENCE

1. (CURRENT TIME, + PERMANENCE,) MINUS (EVENT TIME,) ≥ A SPECIFIED THRESHOLD IN MINUTES

FIGURE 3.1.2-4. CORRELATION ALGORITHM (SHEET 1 OF 3)

CORRELATION SITUATION (CORRELATION PAIRS)	MESSAGE TYPES TO BE TESTED	INCOMING MESSAGE TEST – LOGICALLY "ANDED" CRITERIA –							LOC CON STRAINT		TIME CON STRAINT		DATA BASE CORRELATION TEST – LOGICALLY "ANDED" CRITERIA –					
		TARGET CATEGORY	METHOD OF DETECTION	TGT WORTH	LOC ERROR	TFIRE ADDRESSABLE	PERM						AGENCY	TARGET CATEGORY	METHOD OF DETECTION	TGT. WORTH	LOC. ERROR	ENEMY UNIT TYPE
• OCCUPIED ASSEMBLY OR FORCE CONCENTRATION AREA (SIGINT MOVER)	CA2 C04B (SIGINT)	ASSEMBLY AREA	INTERCEPT OR COMMINT OF		1				2		1			TRACK LOSS	MTIR	1		
• SHOOTER LOCATION TUBE ARTILLERY (TACFIRE PHOTINT)	DA4A (TACFIRE SUSPECT SHOOTER)	ARTILLERY				YES			2		1			ARTILLERY	PHOTINT			
• SHOOTER LOCATION TUBE ARTILLERY (TACFIRE SIGINT)	DA4A (TACFIRE SUSPECT SHOOTER)	ARTILLERY				YES			2		1			MET RADAR	ELINT			
• SHOOTER LOCATION TUBE ARTILLERY (PHOTINT TACFIRE)	C05A (PHOTINT)	ARTILLERY	PHOTINT			YES			2		1		DIVARTY	ARTILLERY				
								AND		AND		AND						
• SHOOTER LOCATION TUBE ARTILLERY (PHOTINT SIGINT)	C05A (PHOTINT)	ARTILLERY	PHOTINT			YES			2		1			MET RADAR	ELINT			
• CP C2 (PHOTINT SIGINT)	C05A (PHOTINT)	CP C2	PHOTINT						2		1			CP/C2	INTERCEPT OR COMMINT OF	1		
• SHOOTER LOCATION TUBE ARTILLERY (SIGINT TACFIRE)	CA4 C05B (SIGINT)	MET RADAR	ELINT			YES			2		1		DIVARTY	ARTILLERY				
• SHOOTER LOCATION TUBE ARTILLERY (SIGINT PHOTINT)	CA3 C05B (SIGINT)	MET RADAR	ELINT			YES			2		1			ARTILLERY	PHOTINT			
• ROCKET/SSM SIGINT PHOTINT)	CA3 C05B (SIGINT)	ROCKET/ MISSILE	INTERCEPT	1					2		1			ROCKET/ MISSILE	PHOTINT			
• CP C2 (SIGINT PHOTINT)	CA3 C05B (SIGINT)	CP C2	INTERCEPT OR COMMINT OF	1					2		1			CP/C2	PHOTINT			

FIGURE 3.1.2-4. CORRELATION ALGORITHM (SHEET 2 OF 3)

CORRELATION SITUATION/ (CORRELATION PAIRS)	MESSAGE TYPES TO BE TESTED	INCOMING MESSAGE TEST – LOGICALLY "ANDED" CRITERIA –							LOC. CON STRAINT		TIME CON STRAINT		DATA BASE CORRELATION TEST – LOGICALLY "ANDED" CRITERIA –					
		TARGET CATEGORY	METHOD OF DETECTION	TGT WORTH	LOC ERROR	TFIRE ADDRESSABLE	PERM						AGENCY	TARGET CATEGORY	METHOD OF DETECTION	TGT. WORTH	LOC. ERROR	ENEMY UNIT TYPE
• CP/C2 (SIGINT WITHIN KNOWN ENEMY UNIT AREA)	CA3, CO5B (SIGINT)	CP/C2	INTERCEPT OR COMINT DF	1					1									
• CP/C2 (SIGINT WITH ACCURACY)	CA3, CO5B (SIGINT)	CP/C2	INTERCEPT	1	1													
• CP/C2 (SIGINT/SOTAS)	CA3, CO5B (SIGINT)	CP/C2	INTERCEPT OR COMINT DF	1	1				2		1			CP/C2	MTIR			
• AIR DEFENSE SITE (SIGINT WITH ACCURACY)	CA4, CO6B (SIGINT)	SAM RADAR/ SAM	ELINT		1	YES												
• AIR DEFENSE SITE (SIGINT PHOTINT)	CA4, CO6B (SIGINT)	SAM RA DAR/SAM	ELINT			YES			2		1			SAM RA DAR/SAM	PHOTINT			
• COUNTERFIRE OR GSR SITE (SIGINT WITH ACCURACY)	CA4, CO6B (SIGINT)	COUNTER FIRE OR GSR RADAR	ELINT		1	YES												
• ROCKET OR SSM (SIGINT WITH UNKNOWN ENEMY UNIT AREA)	CA4, CO6B (SIGINT)	MET RADAR	ELINT					AND	2	AND	1	AND						FROG
• AIR DEFENSE SITE (PHOTINT SIGINT)	CO6A (PHOTINT)	SAM RA DAR/SAM	PHO TINT			YES			2		1			SAM RA DAR/SAM	PHOTINT OR ELINT			
• ROCKET OR SSM (PHOTINT SIGINT)	CO6A (PHOTINT)	ROCKET/ MISSILE							2		1			ROCKET/ MISSILE	INTERCEPT	1		
• SUPPLY CS (SIGINT WITH MOVER ACTIVITY)	CA5, CO7B (SIGINT)	SUPPLY OR CS	INTERCEPT OR COMINT DF						2		1			TRACK LOSS OR TRACK ORIGINATION	MTIR	2		
• SUPPLY CS (PHOTINT WITH INDICATED PERMANENCE)	CO7A (PHOTINT)	SUPPLY OR CS	PHO TINT	1			1											

FIGURE 3.1.2-4. CORRELATION ALGORITHM (SHEET 3 OF 3)

3.1.2.1.3 Association Algorithm

Regardless of the results of the correlation processing step, the association algorithm shall additionally relate the incoming target or activity message with previously reported target or activity message data contained in the targeting data base.

Based upon the incoming message type and inferred target category, the data base shall be searched within specified distance and time constraints for specific message type and target category pairs.

- The specified distance and time constraint shall be selected based upon the incoming message type and target category.

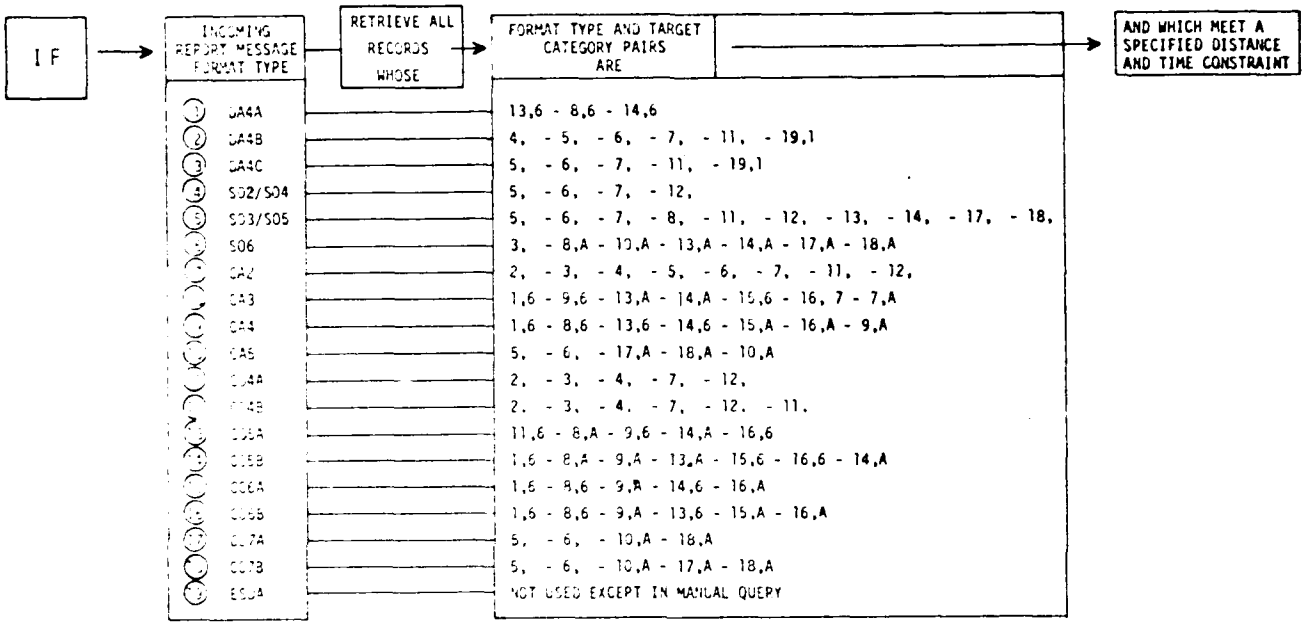
Figure 3.1.2-5 indicates the association algorithm in matrix form. There shall be a row entry provided for each possible message type.

3.1.2.1.4 Assignment Algorithm

The assignment algorithm, regardless of the results of either the correlation or association processing steps above, shall automatically make an assignment recommendation for the incoming target based upon the commander's current rules of engagement reflected within the system in the form of the assignment algorithm table.

The assignment step shall identify whether the incoming target falls within geographic areas addressably by friendly artillery, tactical air support, or attack helicopter.

The assignment recommendation shall take into account dynamic fire control/coordination areas established by the commander or his staff, the areas addressable by friendly weapon delivery means, the



LEGEND: LIST OF NUMBER OF FORMAT TYPE/CATEGORY PAIR NUMBERS REFERS TO FORMAT TYPE INDICATED BY CIRCLED NUMBER ABOVE

NUMBER REFERS TO TARGET CATEGORY IDENTIFIED BELOW

NOTE:

1. COMMA BETWEEN THE TWO NUMBERS MEANS "AND"
2. DASH BETWEEN NUMBER PAIRS MEANS "OR"
3. NO NUMBER AFTER COMMA MEANS DON'T CARE ON TARGET CATEGORY
4. "A" AFTER COMMA MEANS TARGET CATEGORY SOUGHT IS THE SAME AS THAT OF THE INCOMING REPORT

FIGURE 3.1.2-5. ASSOCIATION ALGORITHM

category, worth, accuracy (location error) and permanence of the incoming target (after translation and inference processing) as well as whether the incoming target is indicated as confirmed.

In those cases where the incoming target fails to meet one of the assignment criteria, the system will indicate "no assignment" as the recommended assignment (while still indicating the friendly weapon delivery means, if any, which can address the incoming target location).

Figure 3.1.2-6 represents the assignment algorithm table in matrix form. The rows indicate any of the possible regions (areas) into which the target could fall. The first three regions override (in respective order) all of the other regions and result in the assignment at the extreme right regardless of other parameters.

In situations where more than one weapon asset can strike the target, the assignment shall be based on target parameters in such a manner that artillery is given preference providing the accuracy is less than a specified number of meters and the permanence is greater than a specified number of minutes.

- Failing this, the target shall be assigned to either tactical air or attack helicopter depending upon target category and worth and confirmation status

- Failing this, a "no assignment" recommendation is indicated.

The defined areas in the assignment table shall be taken from the named polygon definitions contained in the control (geometry) record portion of the targeting data base and as such shall be changeable on line.

IF THE INCOMING REPORT LOCATION IS WITHIN AREA(S)	TARGET CATEGORIES (LOGICALLY "OR'D")					RELAT. OPER.	TARGET WORTH (LOGICALLY "OR'D")					NOT SUSPECT	LOC. ERROR	PERM.	THEN WEAPON RESTRICTION/ ASSIGNMENT IS:
	CAT 1	CAT 2	CAT 3	CAT 4	CAT 5		W1	W2	W3	W4	W5				
• WITHIN DIVISION NO FIRE AREA															• NO FIRE AREA
• NOT WITHIN DIVISION NO FIRE AREA BUT WITHIN AREAS RESTRICTED TO COORDINATED FIRE															• COORDINATED FIRE AREA
• NOT WITHIN EITHER DIV NO FIRE OR RESTRICTED COORD FIRE AREAS BUT WITHIN TARGETED LOCATION AREA															• TACFIRE
• NOT WITHIN THE FIRST THREE AREAS, BUT WITHIN TACFIRE ZOF OR HELO STRIKE AREA OR TACAIR STRIKE AREA	ASSEMBLY AREA	CONCEN TRATION	TRACK ORIGIN	TRACK LOSS		AND	50						FAIL		• ATTACK HELO
• SAME CONDITION AS ABOVE													PASS		• TACFIRE
• SAME CONDITION AS ABOVE	ARTILLERY	SAM RADAR/ SAM	CP/C2	SUPPLY/ CS	ROCKET/ MISSILE	AND	50					NO	FAIL		• TACAIR
• NOT WITHIN THE FIRST THREE AREAS OR TACAIR STRIKE AREA BUT WITHIN TACFIRE ZOF OR HELO STRIKE AREA													PASS		• TACFIRE
• SAME CONDITION AS ABOVE							50						FAIL		• ATTACK HELO
• NOT WITHIN THE FIRST THREE AREAS OR HELO STRIKE AREA BUT WITHIN TACFIRE ZOF AND TACAIR STRIKE AREA													PASS		• TACFIRE
• SAME CONDITION AS ABOVE							50					NO	FAIL		• TACAIR

PASS = LOCATION ERROR ≤ A SPECIFIED VALUE IN METERS AND PERMANENCE CALCULATION ≥ A SPECIFIED VALUE IN MINUTES

FAIL = FAILURE OF ABOVE TEST

FIGURE 3.1.2-6. ASSIGNMENT ALGORITHM (SHEET 1 OF 2)

IF THE INCOMING REPORT LOCATION IS WITHIN AREA(S)	TARGET CATEGORIES (LOGICALLY "OR'D")					RELAT. OPER.	TARGET WORTH (LOGICALLY "OR'D")					NOT SUSPECT	LOC. ERROR	PERM.	THEN WEAPON RESTRICTION/ ASSIGNMENT IS:
	CAT 1	CAT 2	CAT 3	CAT 4	CAT 5		W1	W2	W3	W4	W5				
• NOT WITHIN DIV NO FIRE OR COORD FIRE AREAS OR TACFIRE ZOF BUT WITHIN HELO AND TACAIR STRIKE AREAS	ASSEMBLY	CONCEN TRATION	TRACK LOSS	TRACK		AND	30	50							• ATTACK HELO
• SAME CONDITION AS ABOVE	ARTILLERY	SAM RA DAR/SAM	CP/C2	SUPPLY/ CS	ROCKET/ MISSILE	AND	50					NO			• TACAIR
• ONLY WITHIN TACFIRE ZOF													PASS		• TACFIRE
• ONLY WITHIN HELO STRIKE AREA							30	50							• ATTACK HELO
• ONLY WITHIN TACAIR STRIKE AREA							30	50				NO			• TACAIR

FIGURE 3.1.2-6. ASSIGNMENT ALGORITHM (SHEET 2 OF 2)

The area of a specific category such as "division no fire area" or "helicoper strike area" shall not be limited to one polygon definition but may in fact be multiple disjoint or overlapping polygons.

Area definitions of different assignment categories may be either disjoint or overlapping.

Specified parameter values, other than area definitions, within the assignment table shall be changeable by either analyst mode control or a table maintenance processing routine initiated as a background task to the on-line system.

3.1.2.1.5 Display Presentation

The results of target of interest processing shall be reported in two display forms, one alphanumeric and one graphic.

Alphanumeric

The alphanumeric display shall be a report formatted into the five major information segments indicated on Figure 3.1.2-7.

- When more related targets, than the five indicated, result from the correlation and association steps, a multiple page format will be used.

The display shall be capable of presenting 24 lines by 80 characters of information.

The bottom line of the display shall be reserved as an alert line for the targeting analyst.

```
                          TARGET DATA PRESENTATION

TARGET:   XXXXXXXXXXXXXXX     AGENCY:   XXXXXXXX     LOCATION:   XXXXXXXX     TIME:   XXX XXXX
                (1)                        (2)                     (3)                  (4)

RELATED TARGETS:                 QUANTITY:   METHOD:     LOCATION,     TIME:        REFERENCE
          XXXXXXXXXXXXXXXXXXXX     XXXXX     XXXXXXXX    XXXXXXXX     XXXXXXXX     XXXXXX
****      X------------------X     X---X     X------X    X------X     X------X     X----X   **
          X------------------X     X---X     X      X    X      X     X      X     X    X
          X------------------X     X---X     X------X    X------X     X------X     X----X
          XXXXXXXXXXXXXXXXXXXX     XXXXX     XXXXXXXX    XXXXXXXX     XXXXXXXX     XXXXXX
                  (5)               (6)        (7)          (8)          (9)         (10)

**** FIRE MISSION RECOMMENDED      ****   ****   ****   FIRE MISSION RECOMMENDED           ****

ASSIGNMENT:                      TARGET WITHIN ARTY ZONE:   HELO ZONE:   TACAIR ZONE:
          XXXXXXXXXXXXXXXXXXXX                      XXX          XXX            XXX
                  (11)                             (12)         (13)           (14)

     TARGET MESSAGE:  XXXX
       SUBJECT:  XXXXXXXXXXXXXXXXXXXX    CHARS:  XXXXXXXXXXXXXXXXXXXX    LOCATION:  XXXXXXXX
(15)     QTY:  XXXXX  DIR: XXX   VEL:  XXX   PERM:  XXXXX   LOCERR:  XXXX   TIME:  XXXXXXXX
           TARG NO:  XXXXXX          AGENCY:  XXXXXXXXXX        METHOD:  XXXXXXXXXXXXXXXXXXXX
       REMARKS:  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
         XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
```

LEGEND:

(1) Incoming Target Message Target Category Field
(2) Incoming Target Message Reporting Agency
(3) Incoming Target Message Location
(4) Incoming Target Message Event Time

Information items 5 through 10 apply to related target observations retrieved from the data base in accordance with the correlation and association rules. Hits in the data base corresponding to the former are asterisked and cause the system fire mission recommended line to be displayed. The time field can be used as the sort order.

(5) The subject field of the data base record
(6) The quantity field of the data base record
(7) The method of detection of the data base record
(8) The target location of the data base record
(9) The event time of the data base record
(10) The first 6 characters of the record's data base ID

(11) The recommended assignment from the assignment rules (right hand column of Figure 3.2.1-6)
(12) States (Yes or No) whether incoming target location is within at least one friendly artillery unit zone of fire
(13) States (Yes or No) whether incoming target location is within helo strike area
(14) States yes or no whether incoming target location is within TACAIR strike area
(15) A synopsis of the incoming target message containing the fields indicated

FIGURE 3.1.2-7. TARGET PRESENTATION SUMMARY DISPLAY (ALPHANUMERIC)

When the target of interest summary display (alphanumeric) has been processed it shall be entered into the targeting analyst's target of interest work queue and the system shall automatically display an alert line message to the targeting analyst in a manner which does not disrupt the remainder of his display work screen.

All data fields presented in the target of interest summary shall use analyst terminology consistent with the translation subfunction described in paragraph 3.2.2.

Graphic

The principle graphic display for outputting the results of the target of interest processing shall consist of a colorgraphic display containing the following:

- digitized map background data
- control boundaries or indicators such as the FEBA
- grid tick marks
- fire control areas
- maneuver unit zones of responsibility near the FEBA
- target of interest clusters which have not yet been acted upon.

Each incoming target of interest cluster shall be added automatically (without analyst call up) to the graphic display in blinking mode.

- The cluster is defined as the incoming target and the related targets retrieved in the correlation and association process (in some cases there will only be the incoming target).

The incoming cluster shall blink on the graphic side from the time the processed incoming target cluster has been placed in the target of interest work queue until such time as the analyst has retrieved that cluster from the work queue and hence caused the alphanumeric display of that target of interest summary.

From that point, the target cluster shall remain on the graphic in non-blinking mode until such time as the analyst takes some action on that target such as assigning it as a fire mission or reporting it as a target to an operational node, such as a brigade or TACFIRE or deleting it from the graphic presentation.

Graphic Symbol/Color Assignment

Each target in the cluster shall be assigned a symbol from a repertoire of up to 256 displayable symbols which shall include standard alphanumeric and control characters plus application tailorable symbols (see paragraph 3.1.3.3).

The symbol assignment shall be based on the reported or inferred subject data field for targets or enemy activity records and on the enemy or friendly unit type field for enemy or friendly unit records.

- It is desired, although not required, that the graphic display be capable of presenting up to seven different colors which will be assigned as indicated in Figure 3.1.2-8.

3.1.2.1.6 Operator Graphic Manipulation

From the targeting analyst terminal the operator shall be capable of interacting with the target of interest subfunction to perform graphic manipulations with both scenes and symbols. In addition, the operator

INFORMATION	COLOR	BASIS FOR ASSIGNMENT
MAP BACKGROUND	GREEN	------
CONTROL BOUNDARIES	WHITE	------
ENEMY UNITS	RED	------
FRIENDLY UNITS	BLUE	------
TARGETS/ACTIVITY	YELLOW	IF ⟶ METHOD OF DETECTION = PHOTINT
TARGETS/ACTIVITY	MAGENTA	IF ⟶ METHOD OF DETECTION = SIGINT
TARGETS/ACTIVITY	CYAN	IF ⟶ METHOD OF DETECTION = MTI RADAR
TARGETS/ACTIVITY	WHITE	IF ⟶ METHOD OF DETECTION = OTHER THAN ABOVE

FIGURE 3.1.2-8. GRAPHIC INFORMATION COLOR ASSIGNMENT FOR THE TARGETING APPLICATION

shall be capable of interacting with certain of the maneuver-oriented graphics functions as described in Section 3.1.3. Both of these requirements are described below.

Scene Manipulation

The operator shall be able to call, superimpose, or delete in any combination the following set of graphics scenes:

- Target Of Interest Clusters
- Adjunct Overlays
- Unit Situation Display
- Simplified Commander's (Threat) Display
- Map Backgrounds

The operator shall be able to expand or contract any scene or superimposition of scenes that are being currently displayed in accordance with the expansion requirements of paragraph 3.1.3.4.2.

- The expansion or contraction shall occur around a center point designated on the display by means of interactive device, such as cursor or light pen.

Symbol Manipulation

The operator shall be able to position, display, or delete any alphanumeric or target symbol from the target of interest cluster display.

General Graphic Manipulation Capabilities

The operator shall be able to interactively draw through straight line segments the outlines of tactical areas of interest.

The operator shall be able to transfer the end point coordinates of all outlined tactical area of interest to the system data along with a label for future reference.

The operator shall be able to annotate using alphanumeric characters at any point on the screen which is designated by the cursor (or light pen).

The operator shall be able to identify any symbol on the display interactively and retrieve through data base query any information stored about that symbol.

The operator shall be able to obtain interactively cursor (or light pen) readout in MGR coordinates of any point on the graphic display.

The operator shall be able to obtain interactively straight line distances in meters between two designated points on the graphic display.

3.1.2.2 Monitored Area Processing Subfunction

Figure 3.1.2-9 indicates the inputs, processes and outputs of the monitored area processing subfunction. This subfunction shall automatically process all incoming target or enemy activity message data (including that which has already been directly reported by a sensor system to a weapon system) to determine if a threshold value has been exceeded in any area being monitored as described below.

- The performance times stated in paragraph 3.2.1.1 are intended to include the additive impact of monitored area processing on each incoming target message as stated herein.

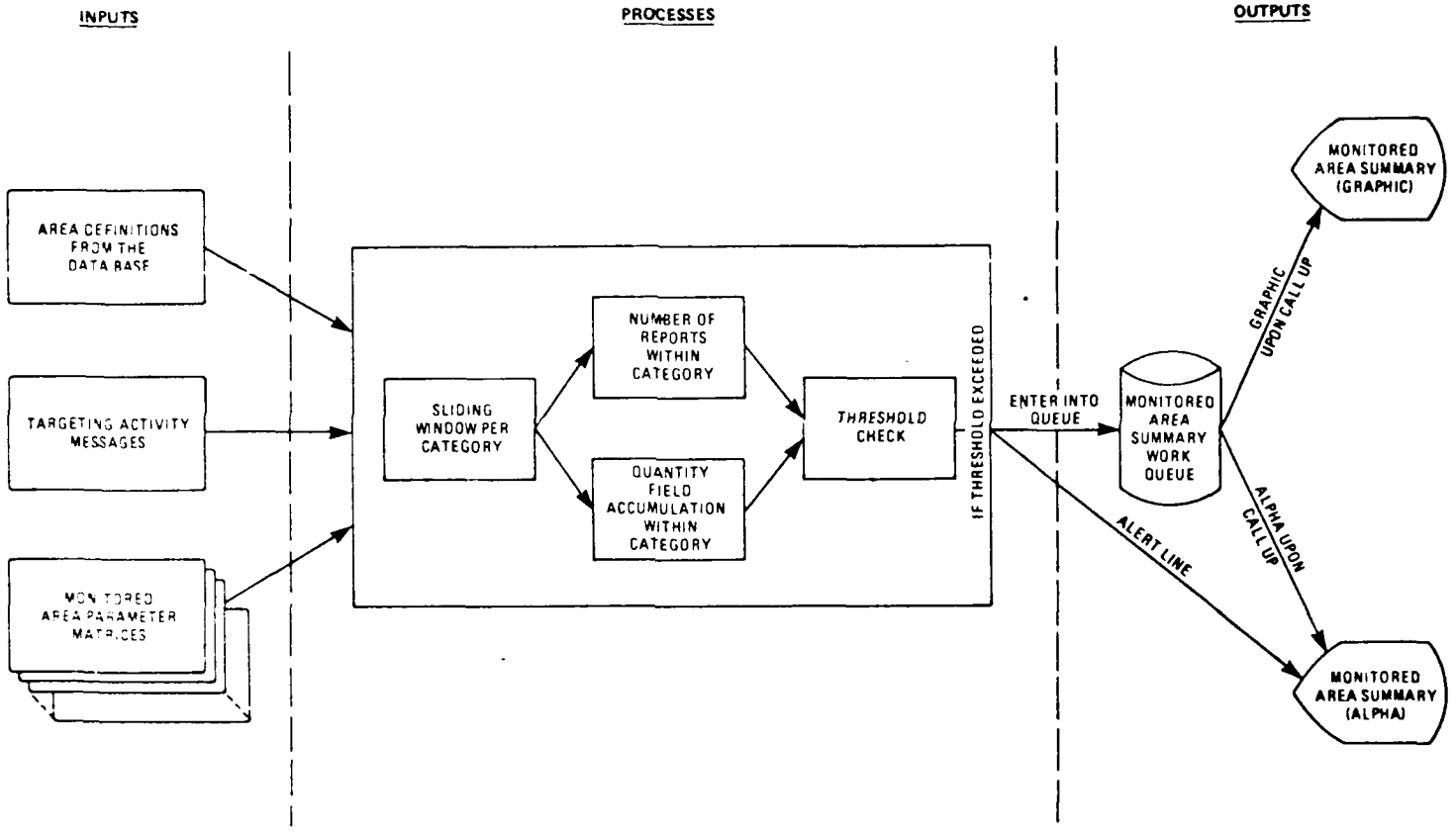


FIGURE 3.1.2-9. MONITORED AREA PROCESSING

3.1.2.2.1 Thresholding

The targeting analyst shall be able to identify a list of "areas" to be monitored.

For each area to be monitored, the targeting analyst shall be able to identify a monitored area parameter matrix (Figure 3.1.2-10) which will state the analyst's thresholds for that area.

- The parameters within each area parameter matrix shall be independent of any other area parameter matrix.

The rows of the parameter matrix shall be any set of eleven inferrable target categories.

For each row, independently of any other row, it shall be possible to establish

- the sliding time window for threshold monitoring within that category

- threshold values for the number of reports (within that category within that sliding time window), and

- quantity field accumulation for all reports received in that category within that time window.

  -- The sliding time window shall be interpreted as the current system time less the specified number of minutes (e.g., a specified time of 30 minutes would only include in the threshold check, data base and incoming reports whose event times were less than 30 minutes old).

TARGET CATEGORY (ONLY THOSE INDICATED WILL BE MONITORED)		SLIDING TIME WINDOW (MINUTES)	NUMBER OF REPORTS THRESHOLD	QUANTITY FIELD ACCUMULATION THRESHOLD
ARTILLERY	X _____	XXX	XXX	XXXX
SAM RADAR:SAM	X _____	XXX	XXX	XXXX
MET RADAR	X _____	XXX	XXX	XXXX
CF:GSR RADAR	X _____	XXX	XXX	XXXX
ASSEMBLY AREA	X _____	XXX	XXX	XXXX
CONCENTRATION	X _____	XXX	XXX	XXXX
COMMAND POST	X _____	XXX	XXX	XXXX
SUPPLY	X _____	XXX	XXX	XXXX
ROCKET MISSILE	X _____	XXX	XXX	XXXX
TRACK LOSS	X _____	XXX	XXX	XXXX
TRACK ORIGIN	X _____	XXX	XXX	XXXX

XXX – INDICATES VISIBLE DEFAULT VALUES –
FILL IN OVERRIDE VALUES WHERE DESIRED

Whenever the system detects a threshold exceeded in any monitored area, it shall prepare a monitored area summary report (as indicated in Figure 3.1.2-11) and enter it into the targeting analyst's monitored area work queue as well as notify the analyst that a monitored area has been exceeded by means of an alert line message displayed on the bottom line of the analyst's alphanumeric display.

- The displaying of the alert time shall not be disruptive to the current work activity of the analyst.

When the analyst draws the report out of the queue a corresponding graphic shall be displayed.

This call up graphic will only contain all target reports (within the respective sliding time windows) of all monitored categories in the monitored area.

3.1.2.3.2 Parameter Change

The Monitored Area Subfunction shall permit the operator to establish/change/delete

- the monitored area definitions
- the target categories to be monitored in each area
- the sliding time values for each category, and
- the threshold values for quantity accumulation and number of reports for each category, in a convenient on-line manner.

Additionally, table maintenance initiated in background mode shall also be possible.

```
AREA:   XXXXXXXXXX        EXCEEDED:   XXXXXXXXXXXXXXXXXXX        QUANTITY:   XXX        THRESHOLD:   XXX
           (1)                              (2)                                 (3)                        (4)

SUMMARY
            MOVERS                               SHOOTERS                                  EMITTERS
   ORIG:    THRU:    LOSS:            TOTAL:    CONFIRMED:    ENGAGED:            ELINT:     COMINT
    XXX      XXX      XXX              XXX         XXX           XXX                XXX        XXX
    (5)      (6)      (7)              (8)         (9)           (10)               (11)       (12)

MONITORED CATEGORY REPORTS:           QUANTITY:   METHOD:    LOCATION:   TIME:      REFERENCE
       XXXXXXXXXXXXXXXXXXX             XXXXX      XXXXXXXX   XXXXXXXX    XXXXXXXX   XXXXXX
  ***  X                 X             X   X      X      X   X      X    X      X   X    X  **
       X       (13)      X             X (14)X    X (15) X   X (16) X    X (17) X   X (18)X
       X                 X             X   X      X      X   X      X    X      X   X    X
       X                 X             X   X      X      X   X      X    X      X   X    X
       XXXXXXXXXXXXXXXXXXX             XXXXX      XXXXXXXX   XXXXXXXX    XXXXXXXX   XXXXXX

ANALYST COMMENTS:   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                                                (19)
```

LEGEND

(1) Monitored Area Name

(2) Target Category (Observation) exceeded of those listed for monitoring in that named monitored area.

(3) Current cumulative sum (quantity field) for the category which exceeded threshold.

(4) The threshold value established for (3) above.

(5) The sum of the quantity field for all mover records whose origination location falls within the named monitored area.

(6) The sum of the quantity field for all active (non-destinated) mover records whose currently reported location falls within the named monitored area.

(7) The sum of the quantity field for all destinated mover records whose destination location falls within the named monitored area.

(8) The sum of the quantity field for all records with target category artillery or rocket missile (within the named area)

(9) The sum of the quantity field for all records with target category artillery or rocket missile which are marked "confirmed" (within the named area).

(10) The sum of the quantity field for all records with target category artillery or rocket missile which are marked "engaged" (within the named area).

(11) The number of records with method of detection = ELINT (within the named area)

(12) The number of records with method of detection = [illegible] COMINT [illegible]

Information in Items (5) through [illegible] will be output for the monitored area [illegible] [illegible] windows any time the display is presented independently of the categories indicated for monitoring.

Items 13 through 19

The following applies to the listing of all reports in the named area which have a category listed for monitoring. The listing should be in event time chronological order with the [illegible] event time listed first. The report which triggered the threshold overflow should be highlighted by leading and trailing asterisks. This report should be the most recently received report but may not be the first report in event time order, hence in the example it is shown arbitrarily as second in the listing.

(13) The subject field of the record

(14) The quantity field of the record

(15) The method of detection field of the record

(16) The location of the record

(17) The event time of the record

(18) The first [illegible] characters of the [illegible] base [illegible]

(19) Free space for storing analyst comments on the monitored area

FIGURE 3-[illegible] MONITORED AREA SUMMARY DISPLAY (ALPHANUMERIC)

3.1.2.3 Mission Request Processing Dissemination Subfunction

Figure 3.1.2-12 indicates the inputs, processes and outputs of the mission request processing dissemination subfunction.

Under targeting analyst initiation, this subfunction shall automatically process the data of a specific target or target cluster into either a mission request, a target report, or a set of target reports and transmit them to the indicated recipient node or element.

The target analyst shall be able to indicate to the system what target or target cluster he wishes to involve in this processing stage.

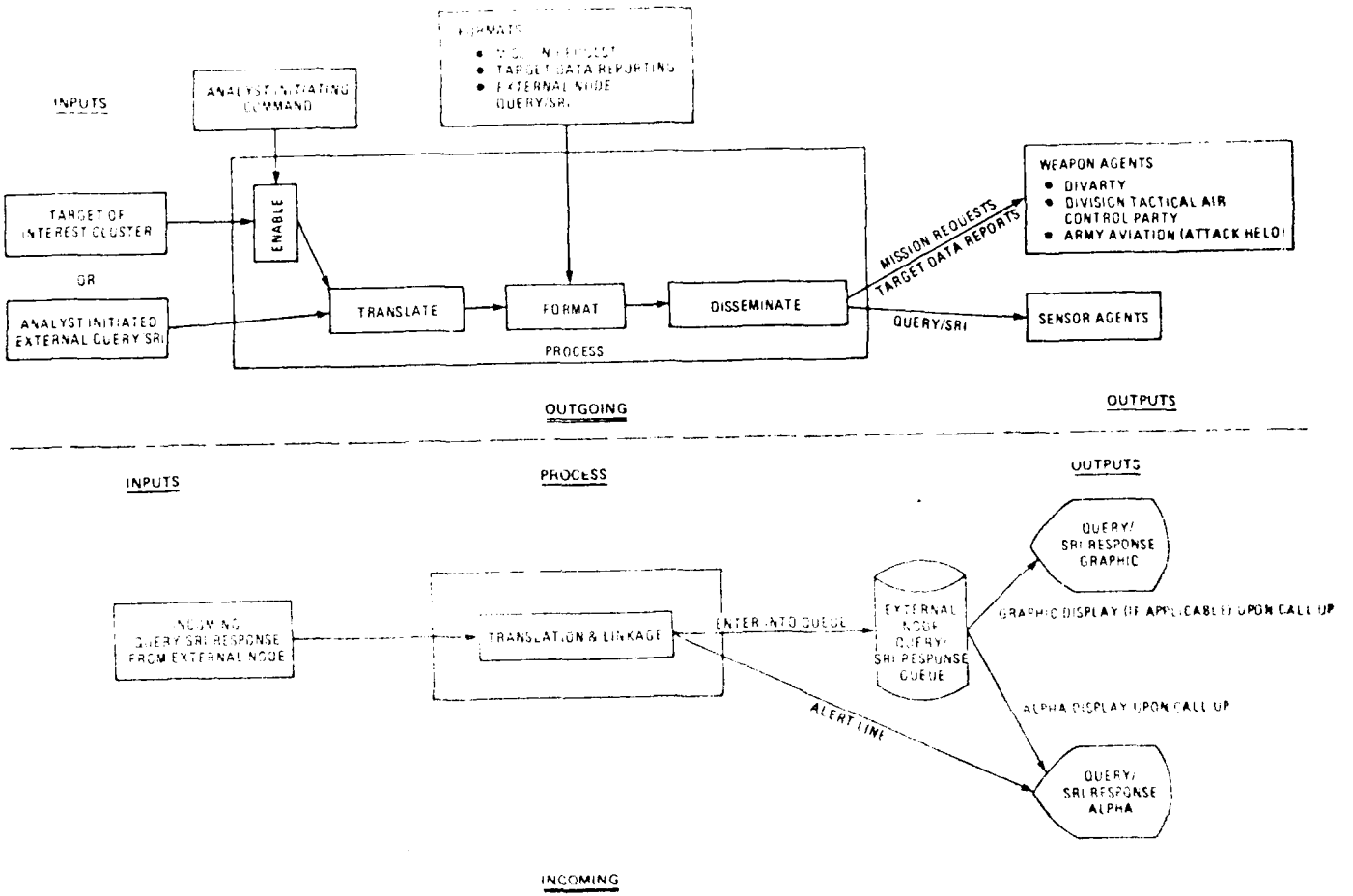
- In the case of target clusters in the target of interest work queue, a simple graphic cursor, light pen or menu selection technique shall be used.

- In the case of ad hoc target processing the analyst shall be able to indicate the targets in the data base he wants to involve in this processing stage by inputting appropriate target reference identification.

The targeting analyst shall be able to establish queries or standing requests for information (SRI) with the interfacing systems.

The analyst shall have the full modifiable prestored query feature support of the data base management/communication system (paragraph 3.2.2) in preparing queries or SRI's to his own data base well as to those of interfacing systems.

- For queries or SRI's to interfacing systems, the subfunction will automatically insert and monitor for a linkage number


INPUTS
ANALYST INITIATING COMMAND
FORMATS
• TARGET DATA REPORTING
• EXTERNAL NODE QUERY/SRI
TARGET OF INTEREST CLUSTER
ENABLE
OR
ANALYST INITIATED EXTERNAL QUERY SRI
TRANSLATE
FORMAT
DISSEMINATE
PROCESS
WEAPON AGENTS
• DIVARTY
• DIVISION TACTICAL AIR CONTROL PARTY
• ARMY AVIATION (ATTACK HELO)
MISSION REQUESTS
TARGET DATA REPORTS
QUERY/SRI
SENSOR AGENTS
OUTGOING
OUTPUTS
INPUTS
PROCESS
OUTPUTS
INCOMING
NOW NO QUERY SRI RESPONSE FROM EXTERNAL NODE
TRANSLATION & LINKAGE
ENTER INTO QUEUE
EXTERNAL NODE QUERY/ SRI RESPONSE QUEUE
QUERY/ SRI RESPONSE GRAPHIC
GRAPHIC DISPLAY (IF APPLICABLE) UPON CALL UP
ALPHA DISPLAY UPON CALL UP
ALERT LINE
QUERY/ SRI RESPONSE ALPHA

such that when the response is received it can be coupled with the initiating query and placed in the analyst's external query/SRI response work queue.

- A non-disruptive alert line will indicate to the analyst that a response has been received.

The analyst shall be able to draw the response out of the queue and display it together with the query or SRI.

Graphic presentation of target query/SRI results shall also be initiated where applicable.

The DIVRAS software system shall perform required translation and formatting both of the query/SRI as well as the responses. The targeting analyst shall not require knowledge of the interfacing node query/SRI formats.

3.1.2.3.1 Translation

For targets or target cluster information, the system shall permit translation/computation/tailoring of the data in this processing stage such that:

1. internally coded data elements can be translated to coded forms used by the recipient systems or the targeting analyst

2. coordinate data can be translated to forms used by recipient systems

3. in the case of target cluster processing, statistical processes or best parameter selection/substitution can be rendered to ensure best target location and location error data is provided in the mission request.

For query/SRI, the translation step shall additionally translate parameter values in conjunction with the formatting step below. Similar translation shall occur for received responses.

3.1.2.3.2 Formatting/Dissemination/Linkage

The system shall provide the necessary software support steps to determine by the choice of an analyst initiated command what format conversions are required and what information elements need be further supplied by the analyst.

The system will automatically perform the required translating/computation/tailoring of the data and format a resultant message in (a) TACFIRE fire mission request format and transmit the message to TACFIRE, (b) a TACFIRE target report in ATI/COR format, (c) Fire Mission and Target Reports to the remaining identified weapon and intelligence interfaces when defined.

The analyst shall likewise be permitted to indicate by command that he wants to view the modifiable prestored query/SFI menu and select an appropriate modifiable prestored query.

- After modification the analyst shall be capable of indicating local or external node query is desired and, if appropriate for that query

- The system shall automatically format it, transmit it and monitor for response and link the response to the initiating query for work queue and display purposes.

The time to select the first page of a query menu by simple command shall not exceed 2 seconds, and a local query requiring a file search (but no summary processing on output) shall not exceed 10 seconds. Each requirement shall be met or bettered at least 80 percent of the time.

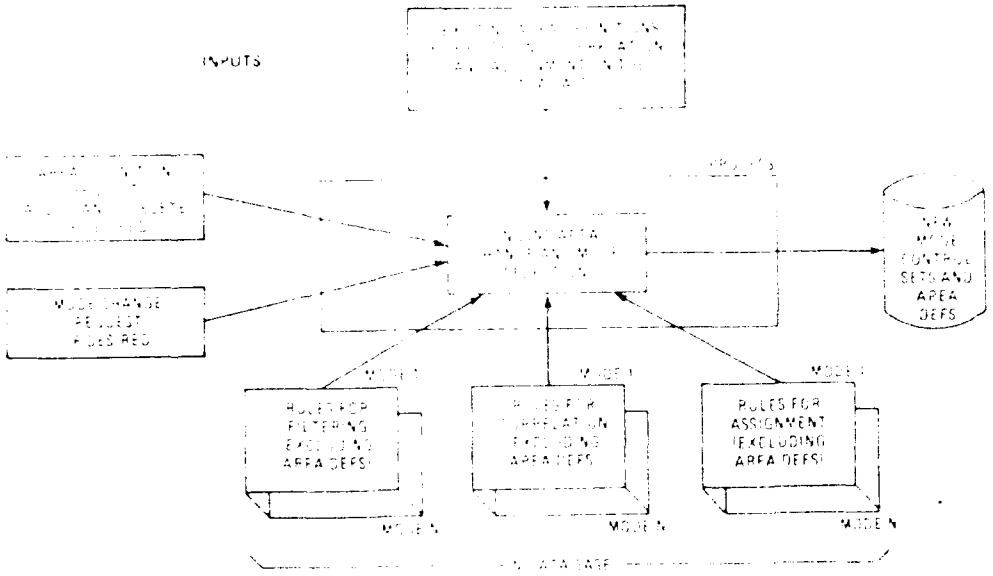
3.1.2.4 Targeting Control Subfunction

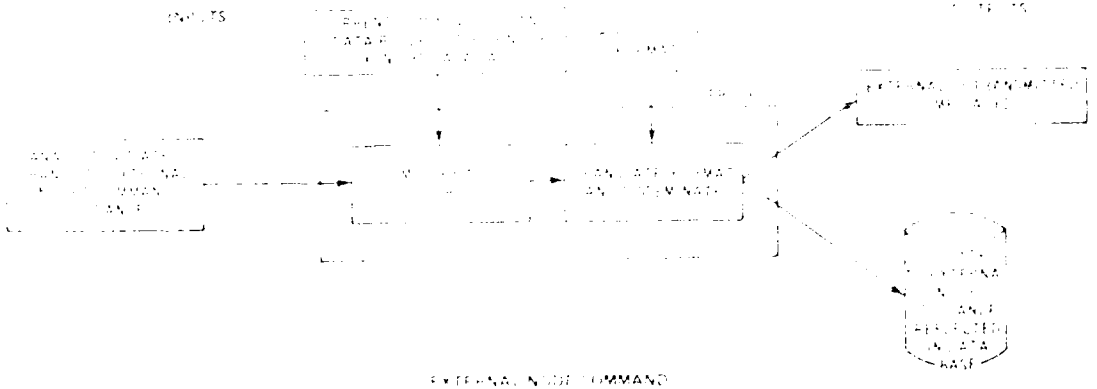
Figure 3.1.2-13 indicates the inputs, processes and outputs for the targeting control subfunction. This subfunction shall permit the targeting analyst to control on-line:

1. the area defintions contained in the control record (geometry) portion of the targeting data base

2. by mode selection, the set of algorithm control tables for current filtering, correlation, association, and assignment within the system.

It shall be possible to modify all tables (including the filtering, correlation, association, and assignment tables) as well as all data base records (including the area definitions in the data base) by means of background task initiation of the appropriate modules specified in paragraph 3.2.2.


INPUTS
OUTPUTS
MODE
RULES FOR
FILTERING
EXCLUDING
AREA DEFS)
MODE
RULES FOR
ASSIGNMENT
(EXCLUDING
AREA DEFS)
MODE N
MODE N
MODE N



The targeting control function shall also permit the targeting analyst to transmit command guidance messages to externally interfacing nodes. The command guidance messages shall include:

1. Reporting instructions to sensor nodes setting conditions for reporting target messages to the DIVRAS system as well as instructions to the sensor nodes setting conditions under which the sensor will additionally directly report a message to a weapon system.

2. Battlefield geometry, zones of maneuver and rules of engagement guidance to both sensor and weapon nodes.

The analyst shall be supported in a flexible manner in accomplishing these control functions with extensive use of menu and light pen selection as described in the preceding paragraph 3.1.2.3. Again, translation/formatting and dissemination support shall be rendered by the system.

3.1.3 Maneuver Application

GENERAL

The objective of the maneuver application function within DIVRAS is to support the Division Commander and his immediate staff through an interactive graphic display of the battle situation made more current through use of real time sensor inputs to update enemy force locations. Figure 3.1.3-1 presents an overview of the maneuver application in terms of inputs, subfunctions (processes), and outputs. Details regarding input data rates are included in Section 3.2.3; representative message formats are included in Appendix 1. A more detailed description of the operational concept is included in the DIVRAS Final Report dated 3 August 1977. Subsequent sections will specify subfunction requirements in more detail.

3.1.3.1 Shooter/Mover/Emitter Processing Subfunction

Figure 3.1.3-2 provides an overview of the inputs, processes and outputs of the Shooter/Mover/Emitter (S/M/E) Processing Subfunction.

S/M/E message traffic shall be forwarded from indicated sources as defined in Section 3.1.1 in accordance with message formats included in Appendix 1.

Without operator intervention the system shall process the data into file.

Validity checking and editing shall be accomplished as the data is processed into file.

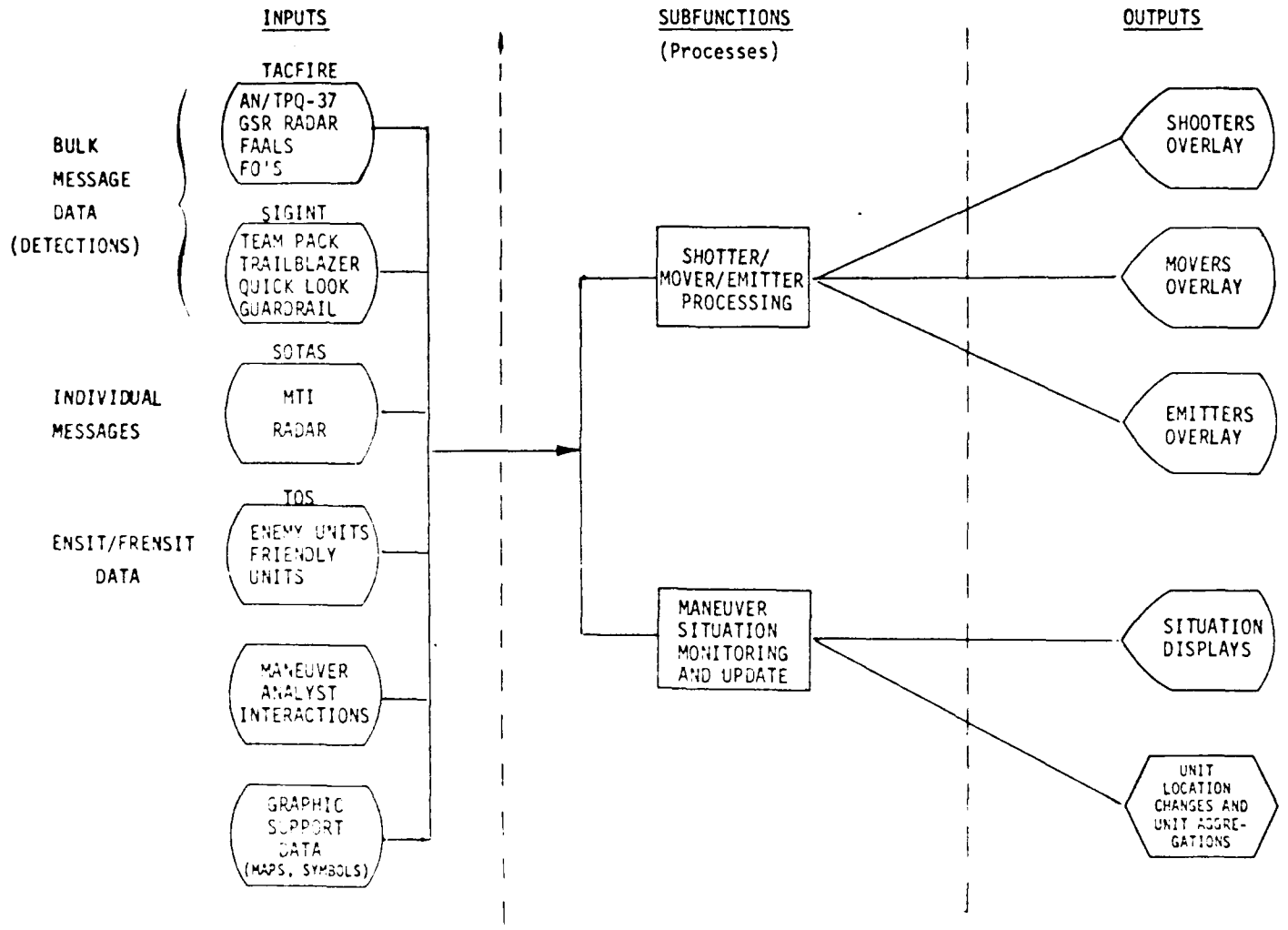


FIGURE 3.1.3-1. MANEUVER APPLICATION OVERVIEW

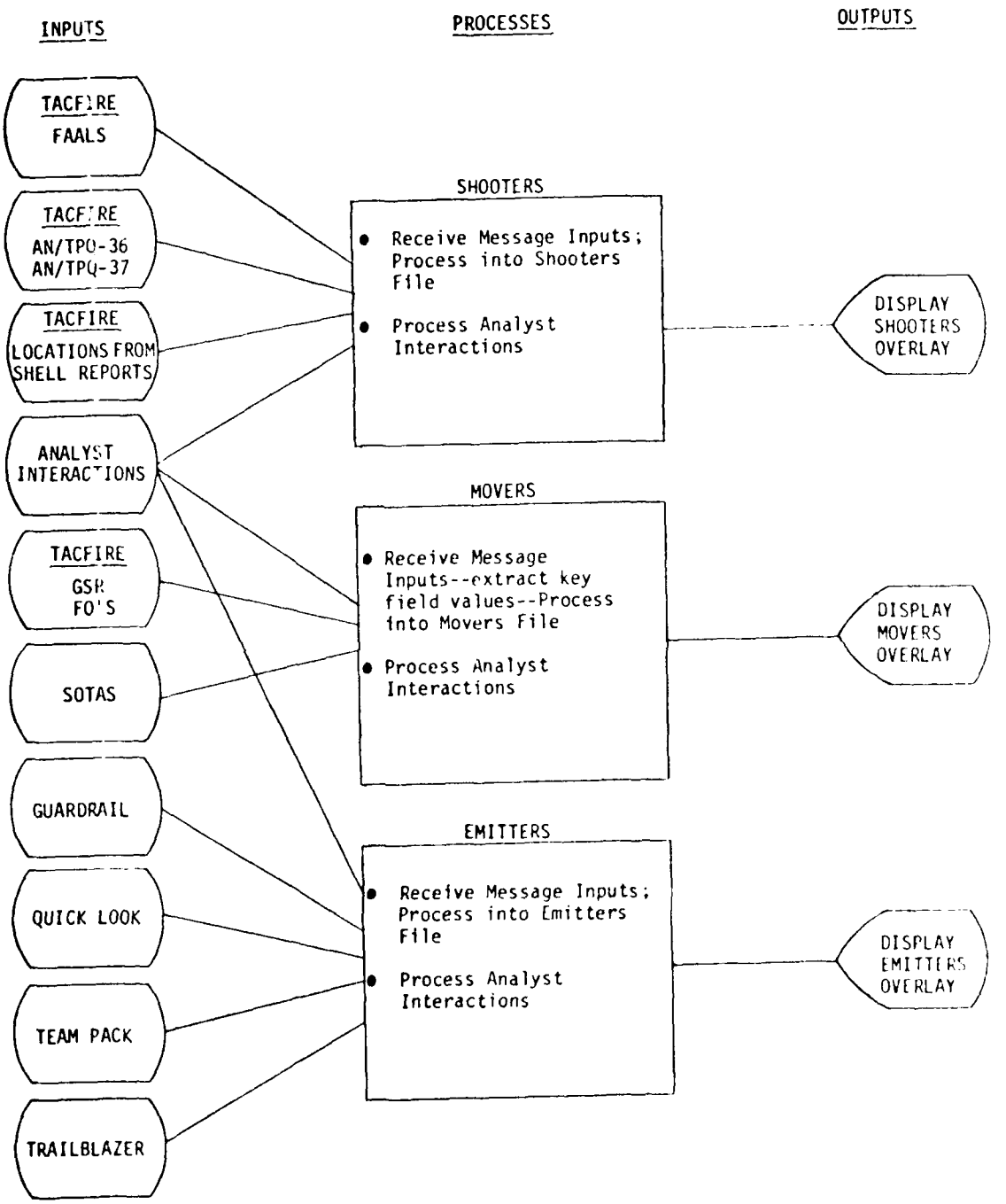


FIGURE 3.1.3-2. SHOOTER/MOVER/EMITTER PROCESSING SUBFUNCTION

The operator at a terminal shall be able to call a Shooter/Mover/Emitter overlay one at a time by actuating a single function key for each type (i.e., one key for shooters, one for movers, and one for emitters).

The operator shall be able to superimpose two or more S/M/E overlays on a single terminal simultaneously.

The operator shall be able to display a Shooter, Mover or Emitter overlay(s) on any level of map background indicated in Subsection 3.1.3.4. Figure 3.1.3-3 shows representative Adjunct Displays superimposed on a map background.

The S/M/E sensor location data, blocked on periodic reporting intervals (see paragraph 3.1.1) shall be further processed into (1) a file under data base manager control for further maintenance and query purposes, and (2) a self-purging buffer for graphics presentation upon maneuver analyst call up.

The graphics presentation buffer shall contain varying time lengths (multiples of the time interval discussed in paragraph 3.1.1) of S/M/E data.

- These varying time lengths shall be pre-set for each category of input data, but changeable by operator action similar to changing parameters in a standing query.

It shall be possible to delete an S/M/E overlay without affecting other overlays that it may be superimposed upon.

The system shall be capable of identifying and storing at least 10 separate S/M/E overlays for future recall.

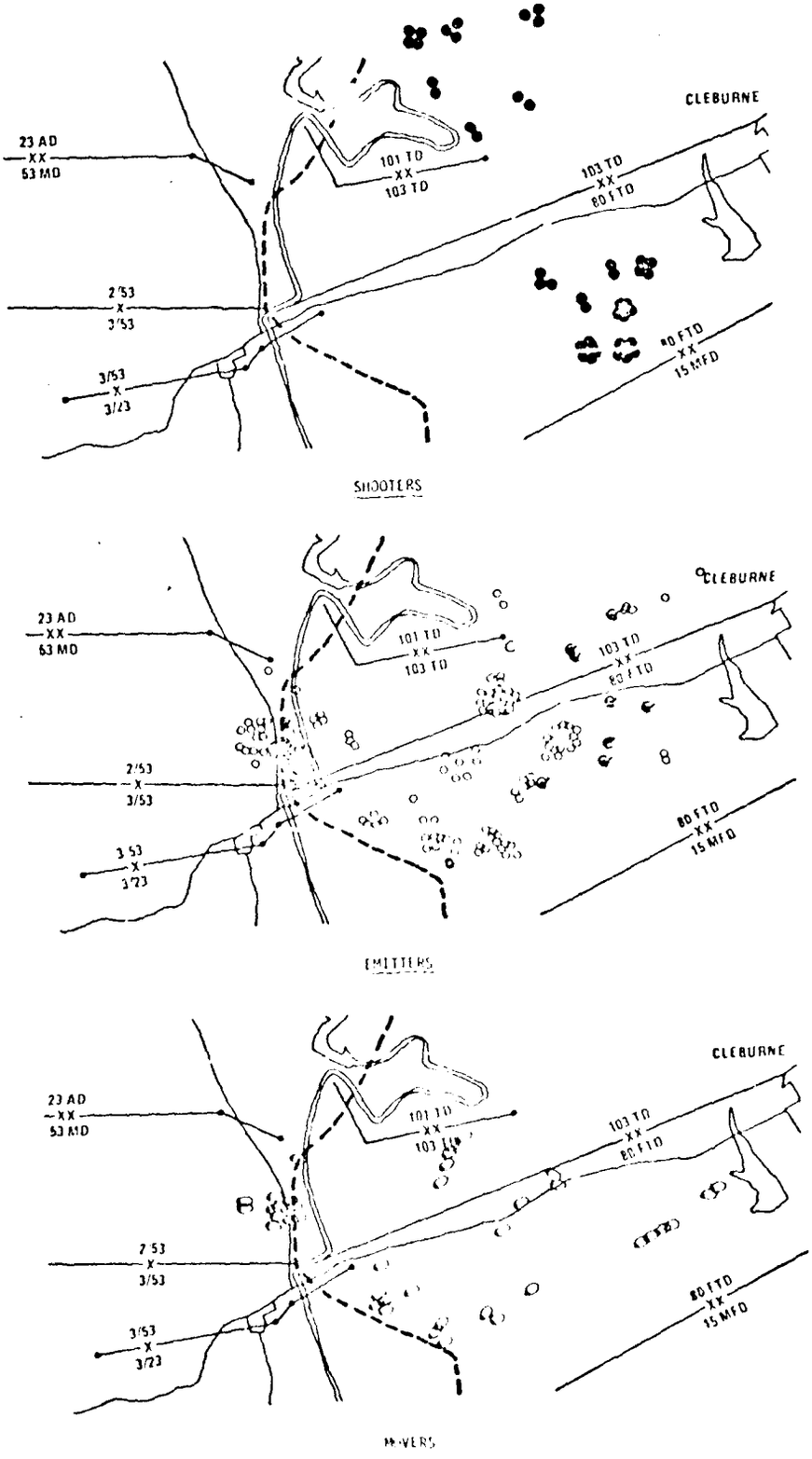


FIGURE 3.1.3-3. ADJUNCT DISPLAYS

The operator must be able to superimpose one adjunct display or more in red over a situation display already on the screen in 3 colors (including red).

- When the adjunct overlay is deleted, the situation display shall remain.

The system shall provide capability for purging of the S/M/E data based on age of the data (see Section 3.2.2.2).

- It shall be possible to set purge criteria independently for each category of input data, and to change each individually once set.

3.1.3.2 Maneuver Situation Monitoring and Update Subfunction

Figure 3.1.3-4 provides an overview of the input, processes and outputs of the Maneuver Situation Monitoring and Update Subfunction. The objective of this subfunction is to provide the capability to maintain within the DIVRAS data base the results of intelligence and operations analyses (ongoing functions performed in the DTOC) regarding locations and status of enemy and friendly units and to display specific portions of this data on operator request. This data base forms a continuously evolving baseline for use in updating the maneuver situation through comparison with real time sensor inputs, i.e., Mover/Shooter/Emitter overlays.

3.1.3.2.1 Unit Situation Display

The operator shall have the ability to access TOS* data needed to create the situation display on request.

INPUTS	PROCESSES	OUTPUTS
	• Receive specified message inputs and process into file or route in accordance with pre-determined distribution criteria	• Display of unit locations over map backgrounds using specified standard symbology (Unit Situation Display)
FRENSIT Data →	• Call up color displays of friendly and enemy unit locations using appropriate symbology	• Display of threats and blocking forces over map backgrounds using threat symbology.
ENSIT Data →	• Add/Change/Delete/Move individual symbols on unit locations display; change scales • Superimpose Adjunct (Shooter/Mover/Emitter) overlays (see Section 3.2.2.1) on unit locations display	• Modifications to situation displays in form of: - revised unit locations - additions to keep track of which units comprise each aggregated symbol
Queries from Analyst Terminals →	• Draw/Label Unit Boundaries and FEBA • Store/Retrieve display scenes	• Display frames to be stored for future recall

FIGURE 3.1.3-4. MANEUVER SITUATION MONITORING AND UPDATE SUBFUNCTION

The operator shall have the capability to call up a display of enemy and friendly unit locations displayed in standard FM 21-30 unit symbology over a map background. For identification purposes this display is called "Unit Situation Display". Operator-controllable parameters shall include (1) friendly or enemy, (2) geographic area, (3) echelon (lowest level to be shown).

- The subfunction shall be capable of utilizing TOS data containing finished intelligence about enemy unit locations and status and presenting it at the Unit Situation Display.

- It will provide access to the FRENSIT application in TOS and present current location and status information about friendly units.

- These parameters shall be enterable at the maneuver analyst's terminal.

To the extent that unit identification data is available in the data base, the system shall automatically assemble unit symbols including unit numbers for display at the appropriate location on the screen.

Where no unit ID is available, a simple open box will be utilized.

Symbols shall be displayed so that the lower left hand corner of the unit symbol corresponds to the coordinates in the data base indicating unit location. Figure 3.1.3-5 shows a representative Unit Situation Display.

Overlapping and superimposition of symbols is allowable.

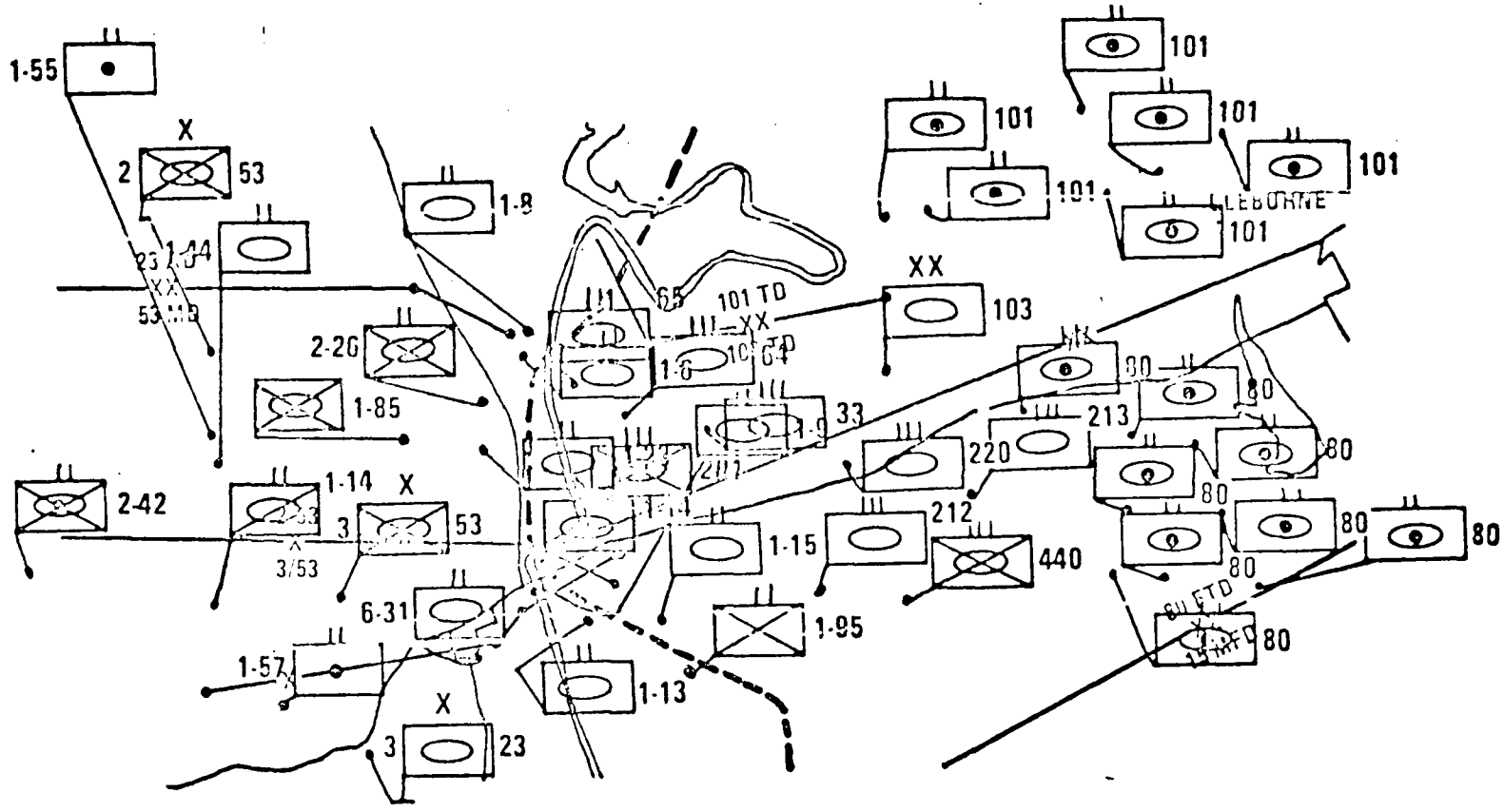


FIGURE 3.1.3-5. CONVENTIONAL UNIT SITUATION DISPLAY

3.1.3.2.2 Simplified Commander's Display (Threat Display)

Through use of console controls and/or function keys, the operator shall have the capability to aggregate elements into larger forces and represent that aggregation through use of appropriate symbology. For identification purposes this display is called "Threat Display"; a representative Threat Display is shown in Figure 3.1.3-6 superimposed on a primary map background.

The system shall retain data accessible by the terminal operator indicating which specific units are aggregated into each aggregated symbol.

Capability to selectively delete or add overlays of map background to the Threat Display shall be provided at the terminal.

The operator shall be able to draw the Threat Display unit boundary lines and forward edge of the battle area (FEBA) interactively from his terminal.

The operator shall have the capability at the terminal to selectively call up Shooter/Mover/Emitter overlays for superimposition on the Threat Display. (Figure 3.1.3-7 is representative of emitters overlaid on a Threat Display).

The operator shall have capability to label and store up to 12 Threat scenes in permanent or temporary storage, either individually or overlaid, for future recall.

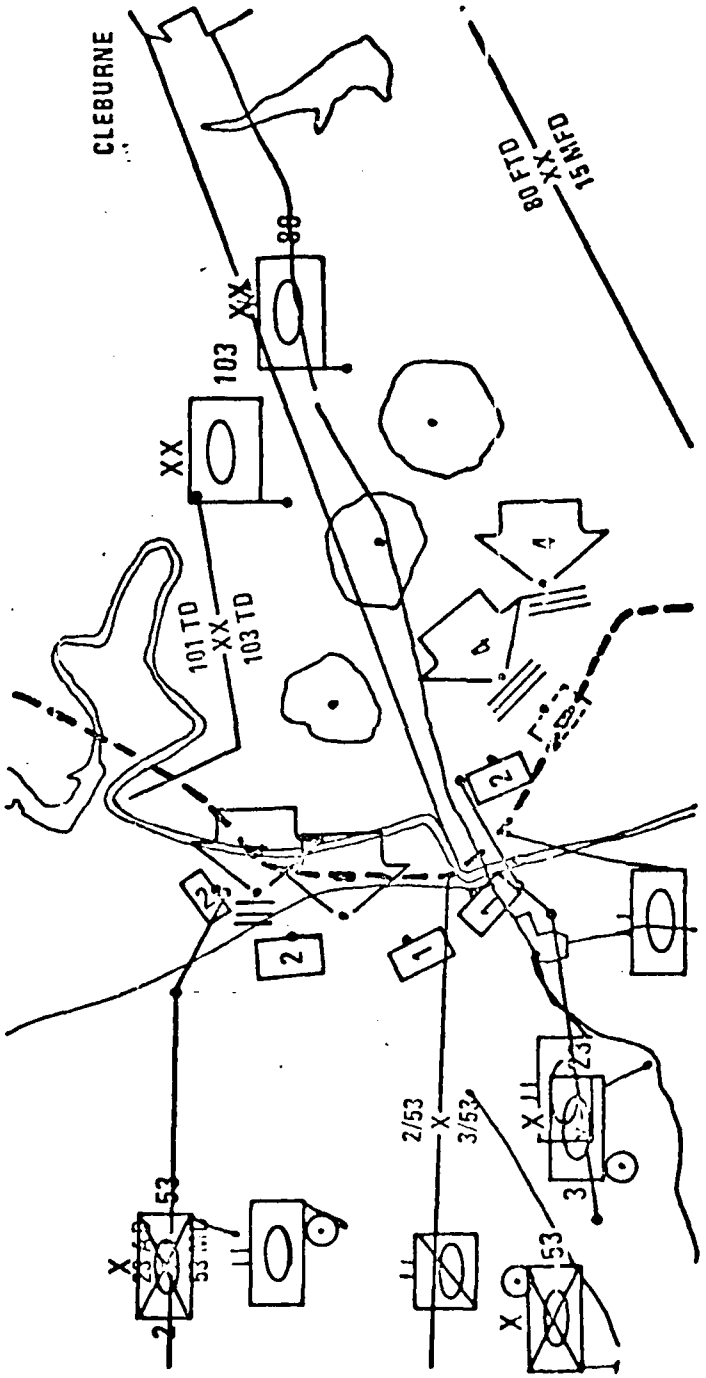


FIGURE 3.1.3-6. THREAT DISPLAY

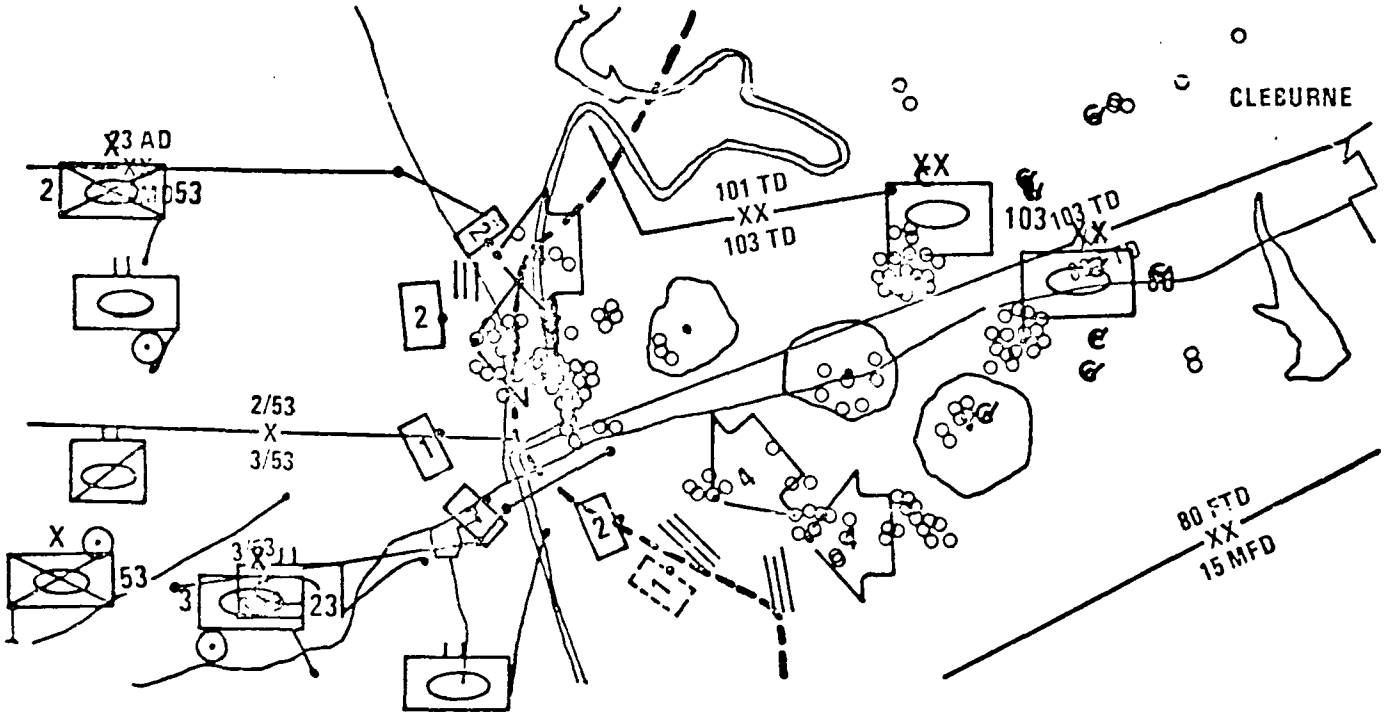


FIGURE 3.1.3-7. THREAT DISPLAY PLUS EMITTERS ON MAP BACKGROUND

3.1.3.3 Symbology

3.1.3.3.1 Standard Symbols

The system shall generate and display the 64 alphanumeric symbols in accordance with the ASCII set.

3.1.3.3.2 Military Unit Symbols

The system shall generate and be capable of displaying a set of standard military unit symbols.

The symbols shall be designed to resemble those illustrated in FM 21-30 (Figure 3.1.3-8).

- The symbol shapes may be modified to allow more efficient display of curved lines by substituting a series of short segments.

The system shall provide the capability for superimposing branch symbols to create a composite symbol.

The point location of a symbol shall be indicated by the lower left hand corner of the symbol for rectangular symbols and at the center for round symbols.

Military symbols shall be presented in at least two recognizable sizes. These shall measure approximately 1/2" x 11/16" for the larger flag symbol and 3/8" x 1/2" for the smaller flag symbol.

- The difference in size ratio shall be not less than 1:1.33 and shall be great enough to allow the operator to recognize

I ECHELON

ARMY	Army	XXXX
CORP	Corps	XXX
DIV	Division	XX
BRIG	Brigade	X
RGT	Regiment	III
BN	Battalion	II
CM	Company	I

II UNIT DESIGNATIONS

UNIT	Unit	Rectangle
AA	Army Air	Propeller
AB	Airborne	Gull's Wings
AD	Air Defense	Radar Dome
ATY	Artillery	Cannon Ball
CAV	Cavalry	Bandoleer
ENG	Engineer	E - On Side
INF	Infantry	Crossed Straps
MECH	Mechanized	Tank Track
TRAN	Transportation	Wheel
MSSL	Missile	Warhead

FIGURE 3.1.3-8. TYPICAL STANDARD MILITARY UNIT SYMBOLS

the size of a single symbol without having examples of both sizes displayed on the screen for comparison.

- Symbol size displayed shall remain unchanged when the screen image is expanded or contracted.

Standard unit symbols generated automatically or in response to manual input instructions for display on the Maneuver graphics screen shall be displayed in red if enemy and in blue if friendly.

3.1.3.3.3 Military Graphic Symbols

The system shall generate and be capable of displaying the military graphic symbols of the type shown in Figure 3.1.3-9.

The system shall provide the capability to create and display at least 10 additional special symbols.

- Once created and the title has beer added to the symbol library, these special symbols shall be as accessible for use as military graphic symbols.

The military graphics symbols shall appear in a color which associates them with friendly action, enemy action, or geographic background. (Color indications in Figure 3.1.3-9 are representative.)

3.1.3.3.4 Threat Symbols

Ability to create and display special symbols of the type shown in Figure 3.1.3-10 shall be provided.

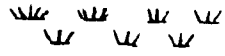
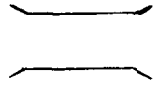
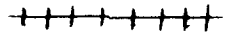
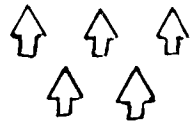
IDENTIFICATION	SYMBOL	COLOR
Obstacle or Built-up Area		Green
Obstacle Minefield		Green
Zone Receiving Artillery Fire		EN Fire = Red FR Fire = Blue
Zone Receiving Air Attack		EN Air = Red FR Air = Blue
Swamp or Marsh		Green
Bridge		Green
Railroad Track		Green
Vegetation		Green

FIGURE 3.1.3-9. TYPICAL MILITARY GRAPHIC SYMBOLS

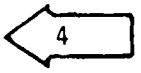
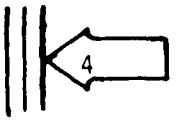
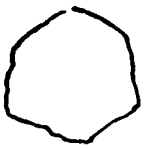
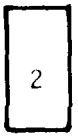
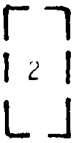
TITLE	SYMBOL	NOTES
Threat Force Advancing		• 360° orientation capability for indicating direction • Numeral(s) for indicating count of maneuver battalion
Threat Force Blocked		• Three parallel lines and arrow are in opposite colors
Stationary Force		• This symbol is used for a force in reserve but capable of becoming a threat force within a specific time interval
Blocking Force in Position		• 360° orientation capability for indicating direction • Numeral(s) for indicating count of maneuver battalions
Blocking Force at Planned Position		

FIGURE 3.1.3-10. TYPICAL SYMBOLS FOR THREAT SCENE DISPLAY

Threat scene symbols shall be designed so that they may be displayed in a range of sizes and aspect ratios.

- The system shall provide the operator the ability to vary a Threat symbol's length over a range from one to 4 and independently vary the same symbol's width in a range from one to 4.

The smallest size symbol shall equate to approximately 2.0 Km in length and 1.5 KM in width when presented against a 1:100,000 map background.

The symbol size displayed will remain unchanged when the screen image is expanded or contracted.

3.1.3.3.5 Adjunct (S/M/E) Symbols

The system shall generate and be capable of displaying special symbols of the type shown in Figure 3.1.3-11.

The point location of a symbol shall be defined by the center of the symbol.

The adjunct symbols shall be presented at a fixed size for all display scales.

All adjunct symbols shall be presented in red.

TITLE	SIZE (APPROXIMATE)	SYMBOL	NOTES
EMITTERS			
Radar	1/4" X 3/8"		Each symbol displayed represents an emitter detection made during a predetermined time interval
Communications Emitters	1/8"		
SHOOTERS			
Artillery	3/16"		Each symbol displayed represents detection of a gun firing during a predetermined time interval
Missile or Rocket	3/8" X 3/8"		
MOVERS			Each symbol displayed represents detection of from 1 to 10 movers during a predetermined time interval
Tracked or Wheeled Vehicle	1/4" X 3/8"		

FIGURE 3.1.3-11. SYMBOL SET FOR ADJUNCT DISPLAY

3.1.3.4 Map Backgrounds

The system shall be designed to provide the user with several levels of map background detail, each callable for separate display or to be superimposed with one or more of the other map backgrounds.

It shall be possible to superimpose one or any combination of these map backgrounds on the current threat scene, the current adjunct scenes, or on any previously stored threat or adjunct scene which has been recalled to the display screen.

In addition to the call up and display of pre-stored digitized map information, the system shall provide the operator with a limited capability to create, modify, label and store the digitized map data from the terminal.

3.1.3.4.1 Levels of Detail

The following levels of map background detail shall be separately callable:

1. A digitized, outline level map providing only gross map features. These shall be limited to principal rivers and bodies of water, primary roads and bridges, and major cities.

   This map shall have incorporated on its horizontal and vertical borders near the screen edges, labeled tick marks in MGR values. Grid ticks will be incorporated at 10 Km intervals over the entire map face.

2. A digitized, mid-level map including additional rivers and bodies of water, secondary roads and bridges, railroads, and other cities not included on the outline map.

3. A digitized terrain map including items such as heavy vegetation areas, swamps and marshy areas and elevation high points.

4. A digitized grid tick map displaying grid ticks and MGR labels in the central portion of the enemy's frontal area so located as to remain visible on the screen for most normally used expansion factors when the border located grid ticks are removed from view by the expansion.

3.1.3.4.2 Area Coverage and Scale

To depict the division level area of interest in full, an area coverage of at least 70 x 90 kilometers shall be maintained in active storage (disk or other high speed, random access media). The DIVRAS system shall have the capability to store additional map areas as follows:

- Small Scale Maps (1:250,000) = 300 km along FEBA x 300 km deep

- Large Scale Maps (1:50,000) = 160 km along FEBA x 200 km deep

The system shall have the capability using appropriate interactive controls to expand from the 70 x 90 Km map scene (called the X1 scale) up to a scale of X8, automatically rescaling and displaying all map elements contained within the bounds of the newly selected map area.

The system shall have the capability using appropriate interactive controls to contract from any of the expanded scale map areas back to any smaller scale (larger map area), automatically restoring, rescaling and displaying all map elements formerly contained within the map area of concern.

The system shall permit via interactive controls the scaling and display of digitized map frames at exactly the scales of 1:100,000 and 1:50,000 whether or not these equate to an integer expansion from the X1 map stored by the system.

3.1.3.4.3 Map Background Color

Map background details will be displayed in a single color selected to be clearly distinguishable from those used for displaying friendly and enemy unit and threat symbols and for displaying military boundaries and related information.

3.1.3.5 Operator Graphic Manipulation

From the maneuver analyst terminal the operator shall be capable of interacting with the Maneuver Application Software to perform graphic manipulations with both scenes and symbols. Major manipulation capabilities are listed in Figure 3.1.3-12. Specific requirements are detailed below.

3.1.3.5.1 Scene Manipulation

The operator shall be able to call, superimpose or delete in any combination the following set of graphic scenes as described in the subsection above:

TYPE OF DISPLAY	RECOMMENDED COLOR	GRAPHIC DATA ENTRY	SCENE/SYMBOL CONTROL
BACKGROUND DISPLAYS	GREEN	• Using cursor, digitize line drawings of simplified map backgrounds including roads, rivers, towns, grids, terrain features; annotate with appropriate alphanumeric labels • Automatically compose Order of Battle Situation frames depicting unit flags, identifiers, echelons, locations.	• Call/Delete Primary Roads • Call/Delete Secondary Roads • Call/Delete Terrain Features • Call/ Delete Grid Indicators Display above overlays singly or in any combination; call one or more as background to threat scenes and/or adjuncts.
MANEUVER SITUATION DISPLAYS	RED & BLUE	• Build overlays on map background depicting enemy and friendly situation using standard unit symbols and special threat symbols, store/recall full scenes including backgrounds • Draw solid lines representing major unit boundaries. Label appropriately. Draw dashed lines representing FEBA.	• Call/Delete Threat Scene Overlays • Add, delete, move, modify, annotate situation symbols superimposed on any map background • Aggregate unit symbols into threats and blocking forces to simplify presentation, show relative combat power and direction of movements.
ADJUNCT DISPLAYS (Shooters, Movers, Emitters)	RED	• Automatically compose adjunct display frames depicting locations/quantities of movers, shooters, emitters over a specific time period which is operator selectable	• Call/delete full scenes of shooters, movers, emitters for superimposition over map backgrounds and/or full threat scenes. (Individual symbols not interactive)
GENERAL		• Build scene; store/recall from temporary working file	• Offset and expand in even increments (X1, X2, etc.) all data on screen maps and overlays) • Advance to next scene, or advance/return to a specified scene in a sequence

[illegible] GRAPHICS MANIPULATION CAPABILITIES

Adjunct Scenes

- Shooter Overlay
- Mover Overlay
- Emitter Overlay

Unit Situation Display

Simplified Commander's (Threat) Display

Map Background

- Primary (Level 1)
- Secondary (Level 2)
- Terrain (Level 3)
- Expanded MGR Grid (Level 4)

The operator shall be able to store and label for future recall the following set of graphic scenes:

Adjunct Scenes

- Shooter Overlay
- Mover Overlay
- Emitter Overlay

Simplified Commanders (Threat) Display

The operator shall be able to recall in time sequence the previously stored scenes of the Simplified Commander's Display.

The operator shall be able to expand or contract any scene or superimposition of scenes that are being currently displayed in accordance with the expansion requirements of paragraph 3.1.3.4.2.

The expansion or contraction shall occur around a center designated on the display by means of an interactive cursor, or light pen.

3.1.3.5.2 Symbol Manipulation

The operator shall be able to position and display interactively any of the symbols from the following symbol sets as described in paragraph 3.1.3.3:

- Standard Military Unit Symbols
- Military Graphic Symbols
- Threat Symbols

The operator shall be able to move or delete interactively from display any of the symbols from the following symbol sets:

- Standard Military Unit Symbols
- Military Graphics Symbols
- Threat Symbols

The operator shall be able to rotate interactively any of the Threat symbols in order to indicate the orientation or direction of the represented force.

The operator shall be able to append a staff to any of the Standard Military Unit symbols and to offset and bend the staff.

3.1.3.5.3 General Graphic Manipulation Capabilities

The operator shall be able to interactively draw through straight line segments the following:

- FEBA (using dashed lines)
- Unit Boundaries
- Outlines of areas of tactical interest.

The operator shall be able to annotate using alphanumeric characters at any point on the screen which is designated by the cursor (or light pen).

The operator shall be able to identify any symbol on the display interactively and retrieve through data base query any information stored about that symbol.

The operator shall be able to obtain interactively cursor (or light pen) readout in MGR coordinates of any point on the graphic display.

The operator shall be able to obtain interactively straight line distances in meters between two designated points on the graphic display.

The operator shall be able to control the time interval for data displayed on the Shooter/Mover/Emitter overlays through selection of one of four interval settings.

- The time intervals applied for each Shooter, Mover, and Emitter overlay for each interval setting shall be enterable through table entry at the operators terminal.

3.2 SYSTEM SUPPORT SOFTWARE

3.2.1 Communications Processing Subsystem

The communications processing subsystem shall provide:

1. Communications line control and monitoring
2. Communication task supervision
3. Data separation and buffering
4. System logging and recovery
5. Interface with the graphics/data base management processing subsystems

Figure 3.2.1-1 portrays the relationship of the processes within the communications processing subsystem.

Line Control/Monitoring

This subsystem function shall terminate the external communication lines and provide control for:

1) modem/cryptography interfaces (synchonization/clocking)

2) line data receipt and transmission (protocol handling, serial/parallel data conversions)

3) error encoding/decoding and error handling (recovery/ retransmission)

4) line state diagnostics (GO-NO-GO line monitoring, wraparound isolation checking, test message transmission/receipt/ checking).

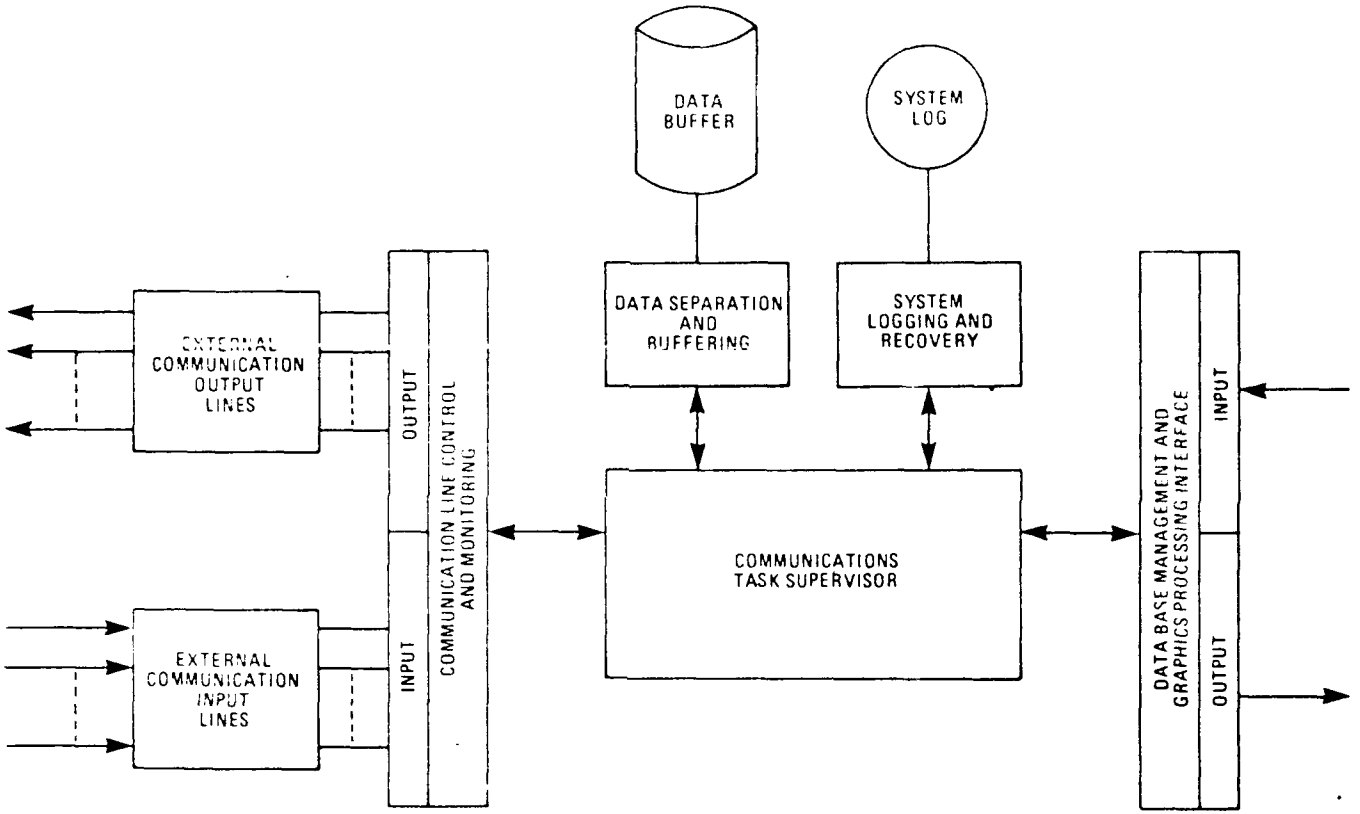


FIGURE 3.2.1-1. COMMUNICATIONS PROCESSING SUBSYSTEM OVERVIEW

Hardware/software tradeoffs are required when actual line protocol and electrical interfaces are determined to assess the degree to which the above functions are to be implemented in the communications processing software versus per line or multiplexed line hardware or firmware (microcode function circuits).

Task Supervisor

The task supervisor shall control the taskable subfunctions within the communications processing software to accomplish the communications processing function. It shall respond to each hardware control signal coming from any of the external communication lines and schedule line control processing to provide appropriate response action. (As stated above, this can be on a bit by bit basis for some or all lines depending on hardware/software tradeoffs.) It shall also respond to input/output commands from the graphics/data base management processing functions and either directly accomplish or schedule appropriate response action. It shall also queue and schedule tasks between communication processing subfunctions as a result of each subfunction task completion.

Data Separation and Buffering

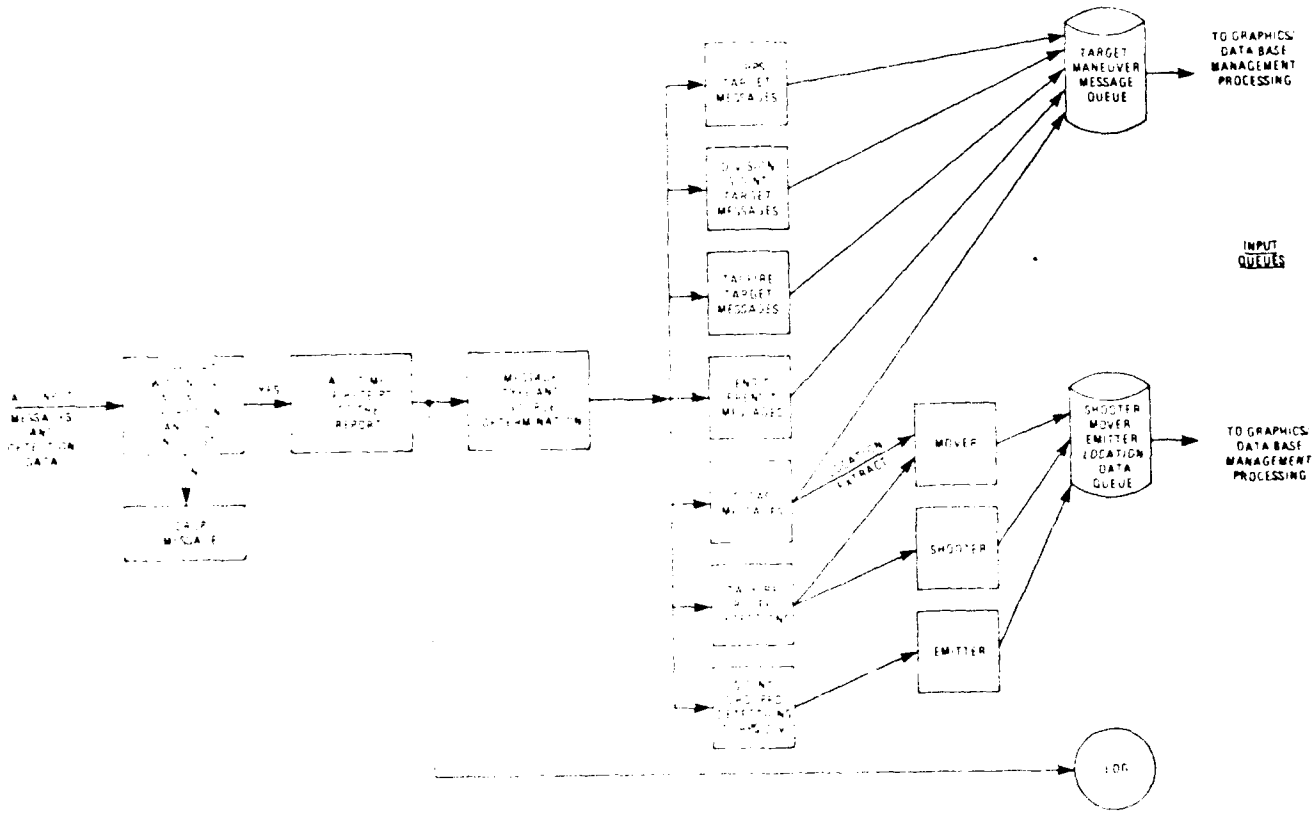
This subsystem function shall process all incoming information from the external communication lines and build two distinct data queues for the data base management processing (in order to support the targeting and maneuver functions). This subsystem shall also provide for buffering between the external communication line rates and the asynchronous graphics/data base management processing rates.

Figure 3.2.1-2 indicates the data separation function. The incoming message traffic contains target messages or unit data messages as well as messages containing a group of detections from specific sensor nodes. The data separation function shall take all of this traffic and create: 1) a first-in first-out message queue which will contain enemy or friendly unit messages and enemy activity messages from the ENSIT/FRENSIT applications as well as individual targeting messages from the sensors, but no data from the group detection messages; and 2) a time-grouped queue of location data (organized by shooter, mover, emitter) assembled from the group detection data as well as the SOTAS target message data.

Both these queues shall be controlled by the communications processing function to ensure no loss of data and shall be passed to the graphics/data base management function on demand of those functions. The demand rate for the first queue shall be asynchronous with the demand interval not exceeding 180 seconds. The demand rate for the second queue will be approximately periodic at the rate of the time grouping factor stated above. This time grouping factor shall be changeable (between 5 and 15 minutes) and will also determine the group detection message reporting periodicity for those externally affected nodes.

Data Logging/Recovery

The data logging/recovery function shall record all messages and detection data on a system log. In certain non-catastrophic failure modes of short duration, it shall be possible to play back from the system log without loss of any data.



PROCESSING/DATA SEPARATION SUBFUNCTION

Interface to Graphics/Data Base Management Processing

The communication processing subfunction shall provide an interface to the graphics/data base management subsystem. If the communication processing subsystem is implemented in a separate computer the interface shall be accomplished at a high speed computer to computer transfer rate. If they are implemented in the same computer they shall intercommunicate by placing data in commonly accessible storage. Separate facilities are desired to permit more latitude in the necessary hardware/software tradeoffs to be accomplished in the communications processing subsystem area.

3.2.2 Data Base Management Subsystem

The data base management programs shall support both the targeting and maneuver applications in a flexible manner to enable the system and operating analysts to:

- data base, retrieve and extract all required data
- automatically process inputs and outputs in a flexible manner to permit easy direction, tailoring, and highlighting of important information
- readily pursue important information leads on an ad hoc basis
- easily communicate results to other analysts and interfacing systems.

The basic data base management programs shall contain the capabilities for:

- structure and structure revision of a broad set of files in background task mode. This will ensure that as the application functions evolve, the data base can flexibly change to meet the new requirements in a quick, time responsive manner.
- complete background and on-line file maintenance to include initialization, change and purge of data contained within the various structured files.
- background and foreground (on-line) operational modes to update, logically manipulate, retrieve and output data to using analysts or external nodes.

- complete utility processing in background mode to permit definition, compilation and linkage of user interface routines (tailoring) as well as library storage and maintenance of logic statements, reports and control dictionary/tables.

Figure 3.2.2-1 presents an overview of the inputs, processes, and outputs which shall be incorporated in the data base management function. Basic inputs are in the form of:

- Local terminal network inputs
- Graphic processing inputs (cursor/controls)
- Communication subsystem inputs
- Background task initiations

Basic outputs are:

- Local terminal network outputs
- Outputs to graphics processing (qualified record data for graphical display)
- Outputs to the communications subsystem
- Outputs to the operating system job queue (task initiation)

In addition to these specific inputs and outputs, the data base, as indicated on Figure 3.2.2-1, is often an input/output for many of the processes.

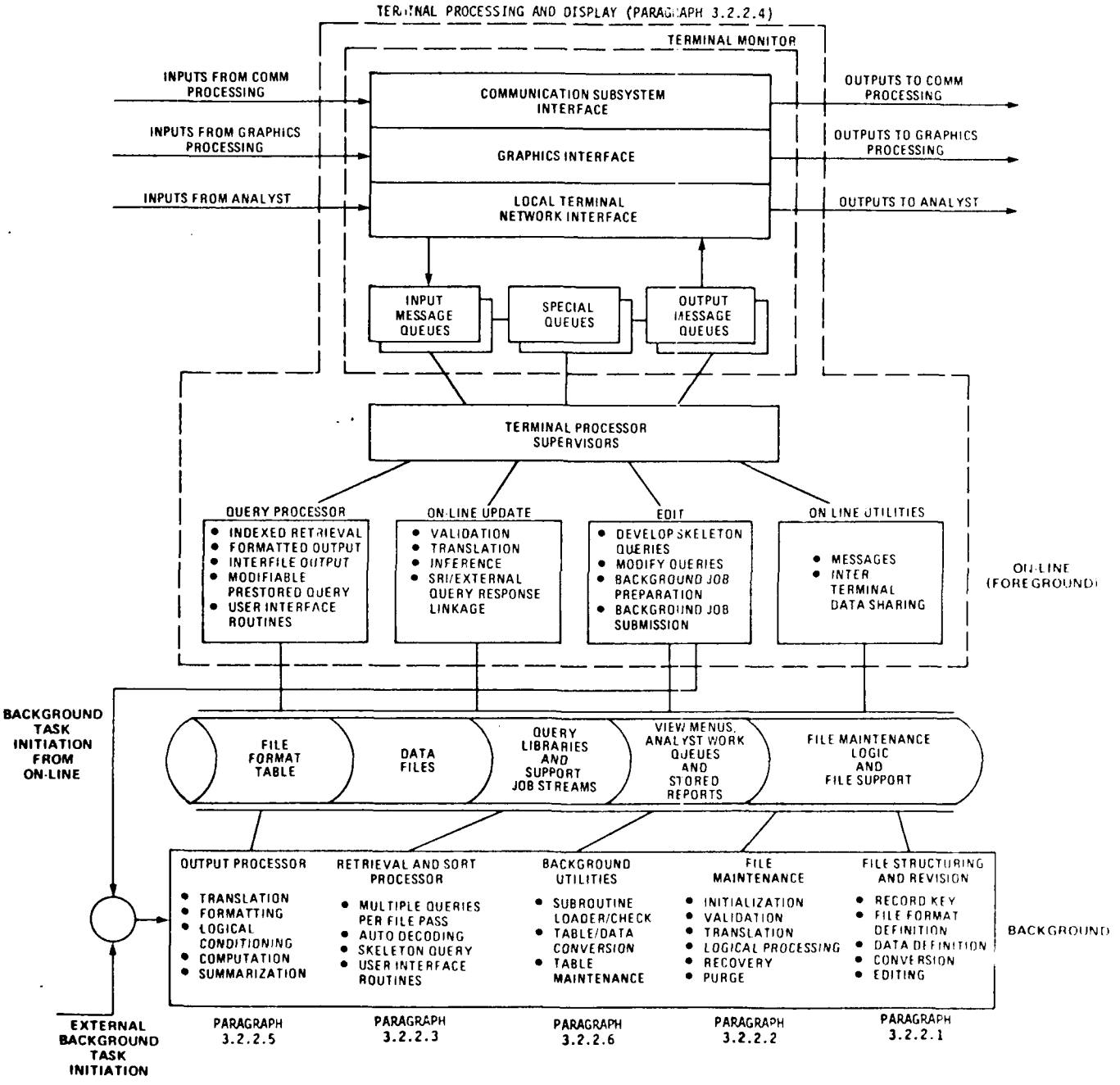


FIGURE 3.2.2-1. DATA BASE MANAGEMENT SUBSYSTEM OVERVIEW

3.2.2.1 File Structuring/Revision

The file structuring/revision subfunction shall permit, in background mode, the creation and reorganization of file structures which are supportive of the targeting, maneuver, functions. This subfunction shall permit non-programmers to specify data structures required to support the applications and evolution of these applications. This shall be accomplished by a simple language convenient to the user. The file structuring subfunction, together with the operating system, shall permit a high degree of independence from the physical data storage.

File Concept

The system shall permit management of a broad spectrum of data in an organizational manner equivalent to the hierarchical organization shown on Figure 3.2.2-2. The description below is representative of the flexibility of the file structure necessary to support the targeting/maneuver application.

The terms used in this subparagraph are defined as follows:

Data Base	A collection of data, supporting the general mission or applications of the system. It is typically composed of many different logical data sets (commonly called files).
Data File	A logical set of data elements, grouped into associated arrays called records.
Data File Records	That collection of data elements identifiable by a unique data value or key.

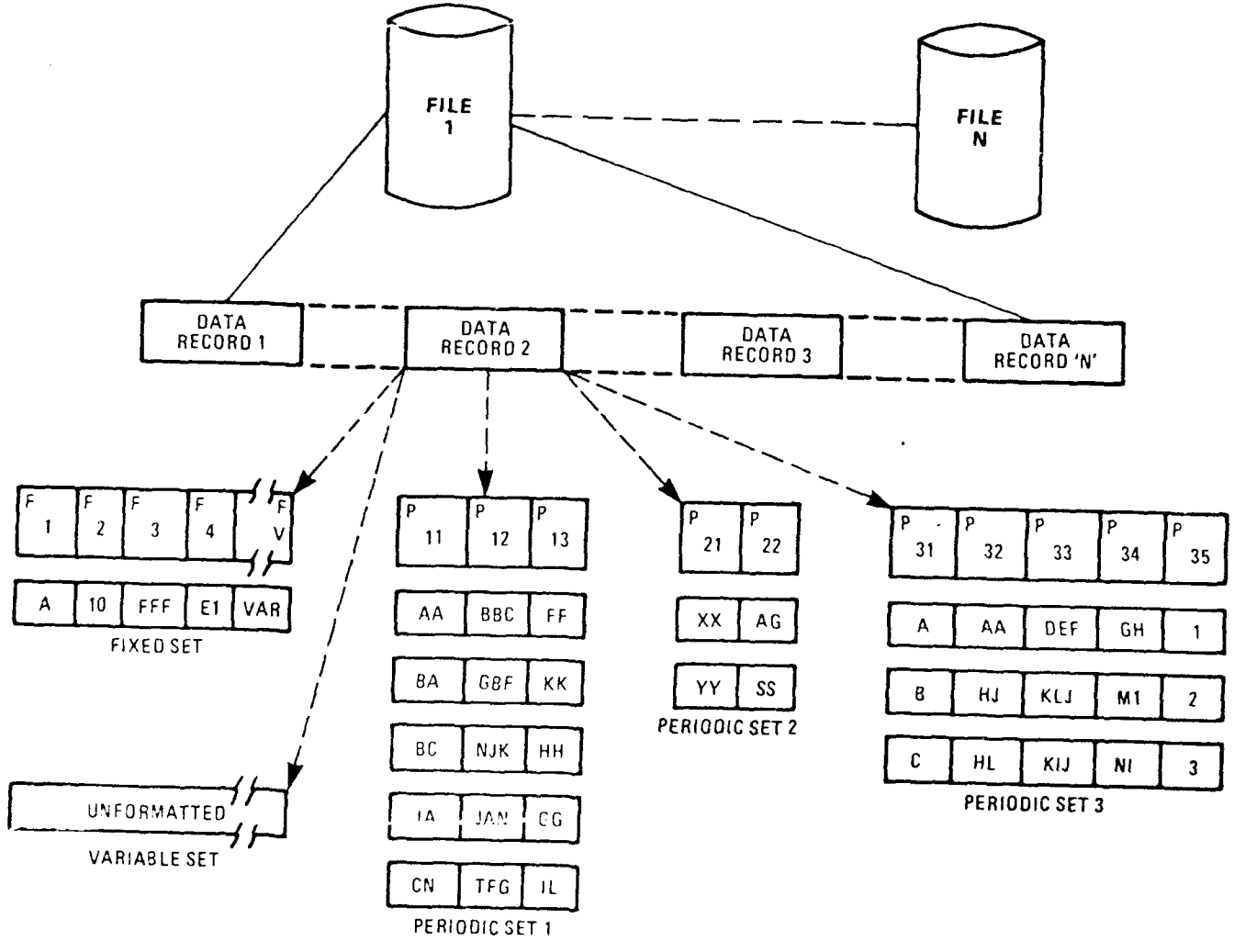
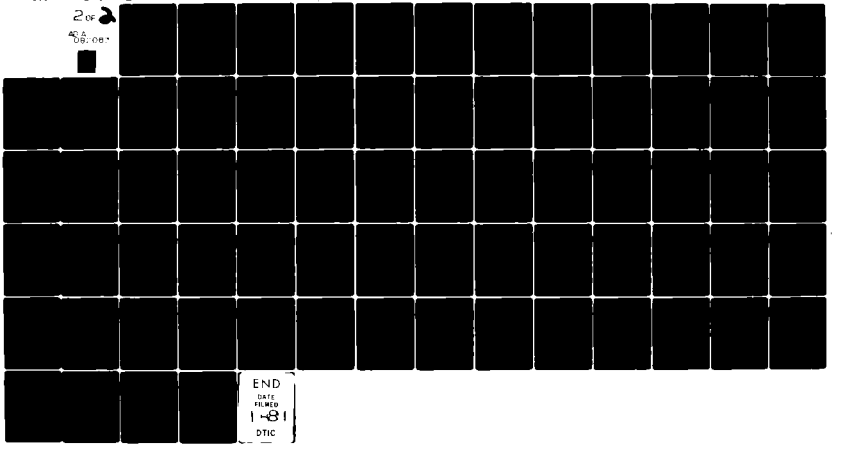


FIGURE 3.2.2-2. DATA BASE ORGANIZATION FOR N FILE DATA BASE

AD-A092 067 IBM FEDERAL SYSTEMS DIV ARLINGTON VA F/G 17/2
DIVISION REAL TIME APPLICATIONS REPORT (DIVRAS), SOFTWARE FUNCT--ETC(U)
AUG 77 DAAG39-77-C-0055
UNCLASSIFIED NL



Field	A single data element.
Secondary/ Keyword Indexing	The capability to index, or access, the contents of a data file by a means other than the record identifier. The index data set is a logical data set of all index values and the data records associated with each.

It shall be possible to carry both repetitive and nonrepetitive information in a file record in fixed and periodic information sets. Collections of field strings having the same format are called sets. Therefore, the string of fields containing nonrepetitive data in a file record shall be defined as the fixed set. Periodic fields, grouped and recurring as strings, are defined as periodic sets.

The record structure within a file shall contain a fixed set, with one level of subordination (the periodic set or sets). The format of a fixed set shall be constant throughout one file. More than one periodic set may be defined in the file structure, but as in the case of the fixed set, the format shall be constant throughout the file on a set-by-set basis. In other words, the format of the first periodic set in each record is the same, and the format of the second periodic set in each record is the same and so on. The formats of periodic set 1 and periodic set n, however, need not be the same.

The user shall be able to:

- include a variable field within the definition of each of the fixed or periodic sets. (This field can contain variable length character strings and shall be included in physical storage only when there is actual data in the field.)

- structure several variable sets. (Each variable set contains a variable length character string and shall exist only when data is present.)

- retrieve records based on the content of variable data fields by either executing a scan of the field for the qualifying value(s) or by employing the keyword indexing capability.

Secondary and keyword indexing capabilities shall be available to enable a user to have more flexible control over his data. Secondary indexing shall permit the specification of fixed-length fields as indexes and retrieval of records based on the contents of those fields. Keyword indexing shall permit the specification of variable fields, variable sets, and fixed-length fields as indexes; selecting values from the field as keywords; and retrieving records based on the presence of the keywords within the queried fields.

File Structuring

File records (the collection of the fixed, periodic, and variable sets which are uniquely identified by a record identifier or key) shall not be defined as to size. The system shall perform dynamically, giving the user a high degree of flexibility. The system shall load into memory only those sets referenced by the job, thereby effectively permitting a significant record size.

During the file definition process, the user shall be able to specify in advance certain automatic functions such as conversion of retrieval literals to coded file values, output data conversions, or editing. If file indexing is desired, the user shall be able to indicate which field or fields will provide the index values. The file structuring subfunction shall provide mechanisms for this purpose and record these characteristics in the basic File Format Table (FFT).

Record control or key fields may be defined as a single field or a string of multiple fields. Periodic subsets may also have data fields assigned for sequencing and control within the record. If the user does not desire to provide these subset control elements, the system shall create sequence numbers for the control function and maintain them as a normal part of the background file maintenance subfunction (paragraph 3.2.2.2).

The file structuring subfunction shall provide a simple, convenient way for the user to specify his file format and requirements. Using a simple free-format language which uses default options, the user shall be able to specify the logical data associations he desires.

Additionally, the file structuring subfunction shall provide for:

- Subroutines/tables for update/maintenance (such as translation) associated with each file

- Edit masks definable for each file.

In the DIVRAS system certain files shall be placed under data management control while others shall contain data required for rapid graphics display call up and need not be formally accessed under the data management subsystem. Shooter/mover/emitter detection data required to support the maneuver application shall be placed under data management control for query purposes as well as processed into a separate file for rapid display call up.

Figure 3.2.2.-3 diagrams the essential contents of the files. Appendix II represents a formatted file table for the Targeting/Maneuver data file which is one of the two under data management control. It shall contain enemy unit, enemy activity and friendly unit, disposition

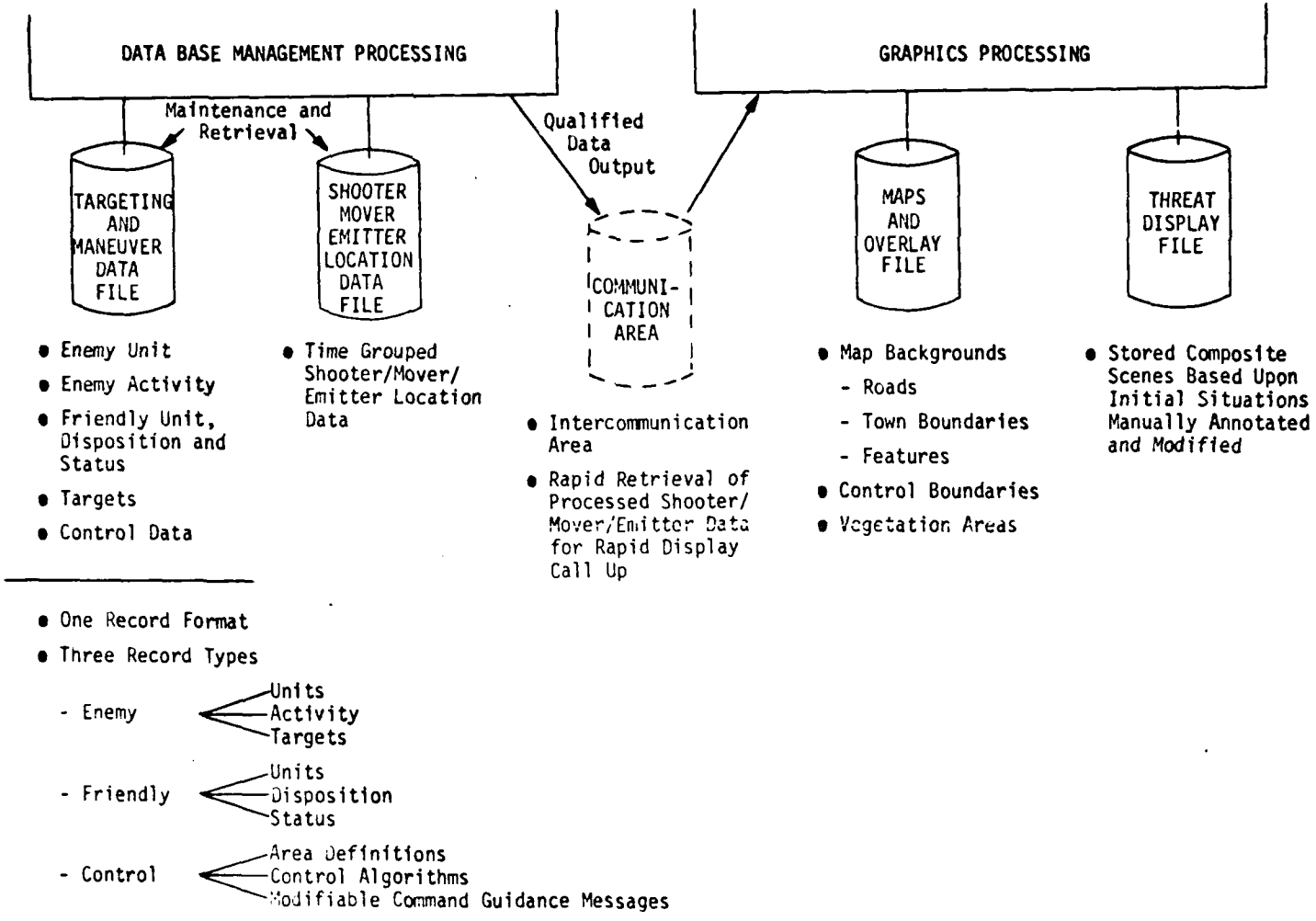


FIGURE 3.2.2-3. DIVRAS DATA FILES

and status information obtained from the TOS ENSIT/FRENSIT applications as well as targeting and control information. For this file, one record definition is assumed. Although equivalent functional alternatives shall be permitted, the discussion below is based on the assumption of one record definition and is included to indicate the structured flexibility required to support the targeting and maneuver application.

Within the one record definition it shall be possible, as a minimum, to distinguish between enemy, friendly, and control record types. (The control record types contain definition information associated with targeting control and rules of engagement.) Each record shall have the same record format and differ only in the physically stored subsets of information.

For example, an enemy record describing an enemy unit would contain the fixed set and as many polygon subsets as desired if there were area definable characteristics associated with the enemy unit (e.g., region of operation, zone of fire--if fire unit, etc.). Also, it would contain the unit data periodic set as well as the target data (or enemy activity data) periodic subset if any target or enemy activity were associated with the unit. It could contain as many "remarks" periodic subsets as desired annotating this enemy unit.

Another example would be an enemy record describing a target. In this case the record would contain the fixed set and as many polygon subsets as desired to describe area definable characteristics associated with the target. Also, it would contain the target (or activity) data periodic subset and as many remarks subsets as desired.

File Revision

The file structuring/revision subfunction shall also provide the capability to revise the format in which data is stored in a data file. This shall be accomplished by the comparison of the FFT describing the file in its current format to the FFT in its revised format. The system shall then generate, as a result of the comparison, file maintenance logic statements which will be used by the file maintenance subfunction (paragraph 3.2.2.2) to copy selected data elements into the new format.

It shall be possible, under the file revision subfunction, to:

- add, delete, relocate fields as well as change their storage mode, size and name

- delete, relocate or add periodic sets (on adding a periodic set no data will be included as a result of the file revision subfunction)

- split any set in the old file into several sets in the new file

- modify all file maintenance logic statements generated by the file revision subfunction under user control.

3.2.2.2 File Generation and Maintenance

The file maintenance subfunction shall provide the user with a background mode capability for generating and maintaining data files. The user shall be able to add, delete, or change file records, periodic sets or subsets, and variable sets. Also, the user may modify or change file fields and may change (increase or decrease) the volume of data

associated with any file record. If indexing is specified for the file, the index data set shall also be maintained. This index data set maintenance shall be automatic and transparent to the user.

All processing shall be controlled by logic statements provided by the user. These statements may be in either a macro-like programmer-oriented language or a high-level procedural English-like language which shall be easy to learn and simple to use. The languages shall include instructions that permit automatic table translation and validation or automatic linkage to user provided, special purpose, subroutines.

The system shall provide an on-line counterpart to this file maintenance capability (see subparagraph 3.2.2.4).

Data Initialization

A method shall be established to initialize the enemy unit and friendly unit data required for targeting and maneuver from the TOS ENSIT/FRENSIT applications. After initialization, the appropriate new or changed unit/activity information shall be made available in real time to the Targeting/Maneuver applications from the TOS ENSIT/FRENSIT applications. The targeting control parameters (excluding control area definitions) shall be initialized at their default value with permitted review and change activity initiated by manual intervention. Control area definitions will be initialized manually. The remaining targeting and shooter/mover/emitter location data is not initialized but is input to the system in real time.

Recovery

A method shall be established to permit the DIVRAS system to recover from certain short period outages employing system log/recovery processing techniques. Catastrophic short period outages, as well as long duration outages will not be recoverable but will require reinitialization of the system.

Purge

The system shall permit initiation of modifiable prestored purge commands which will delete data base information which is no longer needed. The modifiable prestored purge commands shall be capable of logical qualification based upon combinatorial logic involving virtually any of the stored data base fields. It shall be possible for example to purge based upon logical combinations of time, area, target subject, and report source. The control table governing the prestored purge commands shall be a row/column matrix of similar structure and flexibility to that indicated in Figure 3.1.2-3 (Filter Logic Rules) of subparagraph 3.1.2.1. The purge process shall not require cessation of the on-line (foreground) functions. Data integrity shall be preserved during the purge process.

3.2.2.3 Retrieval and Sort Processor

The data management system shall permit background use of a retrieval and sort processor. This processor shall permit broad use of:

- automatic library maintenance capabilities
- standing queries
- compile and go modes of operation

The retrieval and sort processor shall use a simple English-like, free-format condition/action language which is flexible in notation. By specifying the retrieval condition, the user shall be able to select specific records to be retrieved from the data file. Comparison operators which shall be provided are the normal equal to, less than, greater than and between. All may be preceded by the negative operator "not".

Boolean connectors shall be permitted, as well as up to eight levels of nested parentheses. Two geographic retrieval operators shall also be provided: irregular area and circle search. The former shall provide area-to-area, area-to-line, line-to-line, and point-to-area capabilities and shall not be constrained to convex area definitions.

The retrieval and sort processor shall be capable of providing many answer sets, each of different control or sequence, by a single pass of either the entire data file or only those records selected as possible candidates for retrieval by index processing. Satisfaction of the condition shall assign the output of the file record (or a selected portion of the file record) to a temporary file for later system sequencing. Each condition statement may have several associated sort statements. (A sort statement is the string of fields and/or literals upon which the user desires to sequence the answer records.) Conditions may be prestored with their associated sort statements on the query library. The retrieval and sort processor shall also provide for automatic conversion of comparison literals from external form to file form as well as partial field notation and/or literal masking.

A capability similar to the retrieval and sort processor shall be available in on-line mode (see paragraph 3.2.2.4).

3.2.2.4 Terminal Processing and Display

The terminal processing and display subfunction shall make data management processing system attributes for maintaining, updating, retrieving and reporting data available on-line (in real time) to the targeting and maneuver applications. This shall permit automatic functioning between the incoming data stream and the data base (such as target of interest processing - paragraph 3.1.2.1) or manual interaction with either the incoming/outgoing data stream or the data base to occur.

As indicated in Figure 3.2.2-1, the Terminal Processing and Display subfunction shall contain:

- a terminal monitor
- a query processor
- an on-line update processor
- edit capabilities
- on-line utility support

Terminal Monitor

The terminal monitor shall be a main storage resident monitor to service local terminal device or other processing module (i.e., graphics and communication processing functions) requests/interactions and perform input/output queuing. Additionally, one or more terminal processing supervisor(s) may be required to control tasking between the terminal processing subfunction programs (such as query processor, on-line update, etc.) and the terminal or other program users depending upon the number of concurrent tasks dynamically operating in the system.

Output generated by the terminal processing subfunction programs shall be made available to the terminal user for paging in conversational mode or to other processing modules for appropriate processing such as communication output or graphical display.

Query Processor

The on-line query processor shall give the user (either terminal user or other system processing module) an on-line data retrieval language and display language for outputting data. Such on-line processing shall include the capability to execute modifiable prestored retrieval commands.

File records shall be qualified for output by simple or compound conditions being met. Legal subjects of the conditional expression shall be any field and/or group names. The query processor shall be able to limit the number of data records that must be examined in detail through the use of file indexing of potential candidate records when the secondary index function is utilized.

Relational operators shall be provided for equal to, greater than, greater than or equal, less than, less than or equal, between, and not-equal conditions. All relational operators may be preceded by the negative operator 'not'. Geographic search operators shall be provided for determining if a point is contained within an area, a line intersects or is contained within an area, a line intersects a line, or an area is contained within or overlays an area; or for testing if a geographic point lies within a circle defined by a literal consisting of a point and radius.

Any geographic area, line, or point shall also be usable as the selection criterion for producing an output report.

The query processor shall also provide a FUNCTION operator which allows the user to write his own subroutine to assist in record qualification and data presentation. The FUNCTION operator shall be written as a conditional clause and may have in the parameter list literals, indirect address literals (item names), and function work areas.

Compound conditional expressions shall be permitted by the use of the logical connectors AND or OR. An unlimited number and level of parentheses shall be allowed, and where nested parentheses are used, the expression contained in the most deeply nested parentheses is evaluated first. Successively higher levels are evaluated until the truth factor for the entire statement has been determined. The user shall be able to modify the logic of a query compound expression against an item of a repeating group with the ANY modifier. This modifier shall change the conditional logic so that successive terms against the same periodic set are not evaluated within one subset at a time, thus permitting a record to be qualified if an item of a repeating group has different values.

The query processor shall provide for subroutine conversion to qualify encoded values. Subroutine conversion may be specified in the retrieval statement or performed automatically for items designated for subroutine conversion at file definition time. This automatic subroutine conversion may be suppressed or overridden with another subroutine at retrieval time.

The query processor shall provide flexible display output operators. As an example, the user shall be permitted the capability to list the contents of any field and/or group in the file in such a manner as to produce a columnar report. The system shall generate as many columns and output lines as needed to list all of the specified fields; however, if all the fields will not fit on a single line of output, the fields

will be stored by set number and displayed accordingly. When more than one output line is generated for a record, all lines, except the first, shall be idented to be easily identified as a continuation of a record. Column headings shall be generated automatically from the output labels associated with the specified fields/group when the file was defined. If no output label was assigned to the field/group, the field/group name shall be displayed.

The query processor shall provide for computational/logical tailoring of output results to include summation and counting of selected data fields prior to output.

On-Line Update

The terminal processing and display subfunction shall permit on-line file maintenance when required via terminal request or when required by the communication processing function upon input of new data for the targeting/maneuver application.

The on-line update component shall permit translation of externally used data values to coded data base values as required. The translation function shall consist of an expandable argument/function dictionary. Upon input, the argument is the user or external system input name for the data element and the function substituted for this in the data base is the internally coded data element form. Often multiple user names look up the same coded form. A separate table can be used by the output process modules to take the internally coded form as the argument and look up the user or external system output form. User or external system input values do not have to equal output values.

The on-line update shall automatically perform inference processing as required on all input data. Inference processing is the logic through which selected data elements within an incoming message can be inferred

dependent upon the content of one or more other data elements of the same incoming message. When not reported, inference processing shall attempt to infer values for the following target parameters as a minimum:

- Target Category
- Target Worth
- Method of Detection
- Target Permanence
- Target Location Error

Appendix III indicates a representative inference table/rule set. It shall be possible to extend inference processing to more data base fields than those indicated as well as change the inference rules.

On-line update shall be accomplished by means of executing a precompiled file maintenance logic statement against an update transaction entered either by an operator or the communication processing function. The input transaction is validated by the logic statement during execution, if errors are detected, immediate notification will be given to a control terminal operator.

Edit

The edit capabilities within the terminal processing and display subfunction shall permit on-line creation, modification and management of source program statements. From the on-line terminal, it shall be possible to have source programs error-scanned by the component syntax validation routines, corrected, and submitted to the operating system, for background execution. The user shall also be able to write or modify a program, have its language and format verified by the appropriate data base management software component make any recommended corrections, and submit the job for background execution from the terminal.

On-Line Utilities

Utility functions shall be provided to: (1) enable the user to display the current contents of the input message queue; (2) transfer a message from the display station to the computer operator; (3) transfer data sets between terminal stations. (Thus, a set of qualified records produced as a result of an interrogation may be reviewed by other terminal users if the originator so chooses.)

3.2.2.5 Output Processor

This component shall permit flexible formatting of qualified data for output. It shall contain, in addition to normal page formatting capabilities, capabilities for:

- complete logical conditioning of the data
- computation
- summarizations, totaling and subtotaling
- one and two dimensional sum and count matrices
- comprehensive report generation capabilities

3.2.2.6 Utilities

This component shall provide as a minimum:

- complete data validation/conversion table generation capabilities

- facilities for subroutine generation, checking, and loading (with proper linkage for use by all desired data management function modules).

3.2.3 Graphics Processing Software Functions

3.2.3.1 Introduction

Software functions for supporting DIVRAS graphics processing are described in the following paragraphs. The intent is to describe representative functions but not indicate that any one or group of functions be performed in a specific way by a specific programming routine. Any software design approach which allows equally convenient and effective performance of these functions shall satisfy these requirements. The functions are described in two categories:

Applications - Applications dependent functions are those designed expressly for the DIVRAS targeting and maneuver applications.

Graphics Support - Applications independent functions are those providing the functions of image management and image generation which are basic to the digital display capability.

An overview functional diagram of these elements is presented in Figure 3.2.3-1.

3.2.3.2 Interactive Controls

Interactive devices of the types enumerated below shall provide for user communication with displays. Graphics software functions shall provide the appropriate responses when activated by these or equivalent devices.

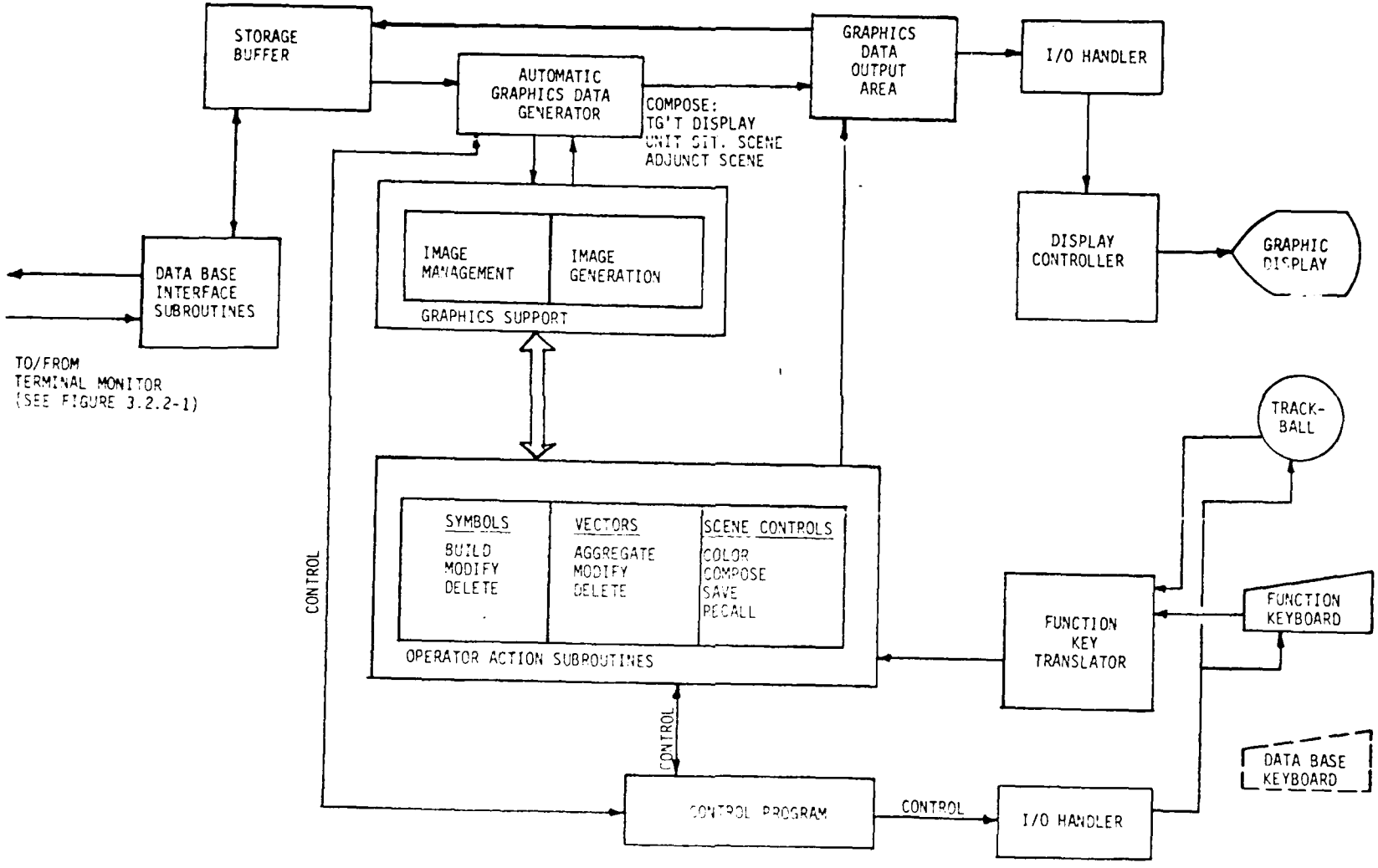


FIGURE 3.2.2-1 GRAPHICS PROCESSING SUBSYSTEM

Function Keyboard

Function keys shall be used to start and terminate functions and routines. Each function key shall be reprogrammable by a computer programmer with sufficient skill and experience to understand the basic software system. Each function key shall indicate when the function it controls is being used by lighting, changing color, or by some other equally visible technique.

Software for translating function key codes shall be designed to support at least 40 separate function keys and at least 300 individual function codes assuming that a hierarchical control tree structure is employed.

Trackball/Cursor

A trackball/cursor combination (or equivalent control) shall be used in conjunction with the function keys and other interactive controls to move symbols, to draw lines, and to perform other functions that require positioning of a point or symbol on the display screen. The cursor, in a crosshair shape, shall be provided to allow the operator to sense location and movement on the screen in response to commands from the trackball. The system shall be designed so that upon request made by function key, the Military Grid Reference (MGR) coordinates of the cursor location are displayed either under the cursor or at some previously designated standard position on the screen.

Alphanumeric Character Set Controls

Suitable key functions shall be provided for displaying the full set of 64 ASCII characters. Supporting software shall be capable of interfacing with a standard typewriter keyboard configuration or

interfacing with the equivalent functions implemented as a part of the function key hierarchical control tree structure.

Blink

The system shall be designed so that any character, symbol, or group of symbols and/or characters may be caused to blink on and off to call the blinking symbols to the attention of the console operator. The system shall be designed so as to start and stop blinking either by software command as a part of the software routine or as a result of depressing a function key and then picking a symbol with the cursor or other control device.

3.2.3.3 Applications Software

The software functions making up the applications program package are described below in the following categories:

- Control Program
- Automatic Graphics Data Generator
- Data Base Interface Subroutines
- Function Key Translator
- Operator Action Subroutines

3.2.3.3.1 Control Program

The control program function shall handle external interrupt communications, the engagement/disengagement of the several application routines and the graphics processing initialization/table load functions. It shall operate in an asynchronous mode. Interrupts will be queued and handled in accordance with predefined priority rules. This program shall gain control of operations whenever all outstanding requests are completed.

At such time the control function enters the wait state until the next request for service is posted.

During initialization the system responds directly to operator communication either via the card reader or via the function keyboard. The objective is to assemble those files, tables and load modules which satisfy the machine configuration, the connected display terminals, and the graphics performance requirements.

3.2.3.3.2 Automatic Graphics Data Generator

This function shall provide the capability to automatically process data base information received from the interface subroutines into instructions and data suitable for transfer to the graphics data output area and subsequent image generation. In the case of target of interest data processing, the function is triggered by the target analysis algorithm and needs no operator initiated action. In the case of maneuvers data processing, the function is triggered by an operator initiated query to the data base subsystem.

Target of Interest Data Processing

This subfunction shall be triggered any time the DIVRAS Target of Interest function (see Section 3.1) makes a decision to display a new target message and its associated graphic. When triggered the sub-function, using message data supplied to it by the data base interface subroutine, shall automatically assemble the graphic instructions/data needed to build the target picture (target symbol type, color and location) and cause these to be transferred to the Graphics Data Output Area which services the Targeting Display.

Situation Graphics Data Processing

This subfunction shall be triggered upon receipt of Unit Situation Display related data base information. When triggered the subfunction, using extracts from the ENSIT and FRENSIT data supplied to it by the data base interface subroutine, shall automatically assemble the graphic instructions/data needed to build all requested symbols (unit type, color, echelon, numeric label and location). These shall be transferred to the Graphics Data Output Area which services the Maneuvers Display.

Shooter, Mover, Emitter Graphics Data Processing

This subfunction shall be triggered upon receipt of Shooter, Mover, and Emitter r lated data base information. When triggered the subfunction, using S/M/E location message information supplied to it by the data base interface subroutine or by direct access to a data set, shall automatically assemble the graphic instructions/data needed to build all requested shooters, movers and emitters (type, location, quantity) and cause this to be transferred to the Graphics Data Output Area which services the Maneuvers Display.

3.2.3.3.3 Data Base Interface Subroutines

The data base interface subroutines listed below shall handle exchange of information between the graphics processing software functions and the data base management subsystem. These interface subroutines shall be designed to accomplish the transfer of formatted requests (generated from the interpretation of function key codes) into the terminal monitor of the data base subsystem and to receive information from the data base subsystem, causing this data to be linked back to the requesting terminal when it enters the graphics processor subsystem.

Interface subroutines shall provide for:

- Transfer of requests to the data base for Unit Situation data, specifying time, area of interest, and lowest echelon for display
- Transfer of Unit Situation graphics related data from the ENSIT and FRENSIT files to the graphics processing subsystem
- Transfer of Target of Interest graphics related data from the target message data files to the graphics processing subsystem
- Transfer of requests to the data base for Shooter, Mover and Emitter data specifying time and area of interest for display
- Transfer of Shooter, Mover and Emitter graphics related data from the data base adjunct files to the graphics processing subsystem
- Transfer to the data base management subsystem of MGR coordinates of a cursor identified symbol or other graphic feature with link to associated query message
- Transfer to the data base of trackball generated polygon shape with link to associated control area message
- Transfer to the data base of completed threat frames with identifier number and time stamp
- Transfer of stored threat frame data from the data base maneuver files to the graphics processing subsystem.

3.2.3.3.4 Function Key Translator

The Function Key Translator subroutines shall be designed to service all manual inputs received through the graphics display function keys. The subroutines shall interpret the key codes and shall invoke the appropriate operator action subroutines thereby enabling and causing execution of instructions for the display, manipulation, storage and recall of graphics data as selected by the display operator's actions (see section below for list of operator actions).

3.2.3.3.5 Operator Action Subroutines

The functions enumerated in this section are those that accomplish processing in response to operator instructions and data entered through the function keys and trackball/cursor. They are the routines that allow the user to build and manipulate symbols and free draw graphics, call and remove scene data and overlays, enter queries into the system via the graphic display console, etc.

These are described below in terms of the function capabilities inherent in the keyboard and trackball/cursor controls.

SYMBOL CONTROLS

Select Symbol Type

When this function is actuated a subroutine shall cause a menu of symbol types to be presented and shall interpret the type selected to the system.

Build Symbol

This function is always actuated with selection of type. As a function of type selected, the BUILD SYMBOL function will invoke the appropriate subroutine to create a new symbol in the graphic display output area of the graphics processor and simultaneously on the display screen.

If symbol type selected is a standard military flag (rectangle) the software function shall compose this from multiple elements in the standard symbol library. A different software function shall be invoked to compose large military graphic symbols such as a minefield, area receiving artillery fire, etc. Still a different software function shall be invoked to compose vector (threat) symbols which are formed by a series of line vectors in a specified arrangement and size.

Another software function shall be invoked to permit rotation of the vector symbols during build. Placement on the screen shall be accomplished either by fixing the symbol origin via trackball/cursor control or via entry of MGR data through the function keys. Software function design shall allow accuracy of placement to within $\pm$ 150 meters with respect to map background at a scale of 1:50,000. The accuracy of orienting vector symbols shall allow rotation to within $\pm$ 5° of the cursor-identified orientation.

Move Symbol

When this function is actuated, a subroutine will be enabled to move the cursor-identified symbol origin to a new screen location. The symbol and all amplifying data shall move as a group to a new screen location as identified by the cursor position. This subroutine will also allow repositioning of the symbol to a new location in response to coordinates entered through the function keyboard.

Declutter

When this function is actuated, a subroutine will be enabled to move the symbol flag (keeping the symbol origin fixed) to a new screen location to allow decluttering. The flag and all amplifying data shall move as a group to a new screen location as identified by the cursor position. This subroutine shall allow bending of the staff between flag and origin, placement of the inflection point being fixed by the cursor location marked by the operator.

Label

When this function is actuated a subroutine will be enabled to allow labeling (applied for the first time or modified) of a standard military unit flag.

Suppress

When this function is actuated a subroutine will be enabled to allow the temporary removal of a symbol from the display screen. The symbol so identified is suppressed but not removed from the graphic data output area of memory. A symbol suppressed in this manner will be redisplayed automatically the next time the stored frame is called up for display.

Delete

When this function is actuated, a subroutine will be enabled to cause removal of a cursor identified symbol from the screen and from the graphic data output area.

Aggregate

This function shall provide a capability to collect a number of unit symbols identified by cursor action for aggregation into one vector symbol. This function will cause an internal table to be written to keep track of the unit names and MGR coordinates associated with a vector symbol. The function will also provide capability to return for display the data stored for each unit in the vector symbol.

FREE DRAW GRAPHIC CONTROLS

Select Line Type

When this function is actuated a subroutine shall cause a menu to be presented and shall interpret the line type selected (solid, dashed or dotted) to the system.

Draw Line Series

When this function is actuated, a subroutine shall enable the cursor for placement of successive point locations which the system will connect with straight line segments. A means will be provided to allow termination of one line series and the commencement of a new line series in either the same or a different line type.

Label Line Series

When this function is actuated, a subroutine shall enable the cursor and keyboard for entry of an echelon symbol and alphameric data identifying the military organization numerals on either side of the echelon symbol.

FRAME CONTROLS

Select Color

When this function is actuated the subroutine shall cause a menu of colors to be presented and shall interpret the color selected to the system.

Change Symbol Size

When this function is actuated a subroutine will be invoked causing the standard military symbols on the display (except alphameric labels) to change size.

Expand
Contract

When either of these functions is actuated, a function will be invoked causing the cursor identified location to become a new center point and causing the screen picture to be appropriately repainted to the operator-specified scale. This subroutine shall handle the functions required to perform off-centering, expansion, contraction and scissoring of screen images. Off-centering shall allow selection by cursor of a new geographic center for an area to be enlarged. Expansion shall provide the computations necessary to rescale all symbol positions and line graphics which still appear in the enlarged image area. Scissoring shall provide for cutting off or stopping graphics data where it runs off the edge of the display screen.

The contract subroutine shall provide for rescaling all symbol positions back to their basic or X1 position. This subroutine shall make provisions for restoring to the display screen any symbol and line vector data that was cut off when the base scene was expanded.

Save Threat Frame (Temporary)
Save Threat Frame (Permanent)

This function shall provide for the temporary or permanent storage of Threat Frames to the data base subsystem.

Display Order of Battle Situation Map

This function shall provide for call up from the data base of Unit Situation data in accord with operator specified input parameters and causing the display of this data on the graphics screen.

Display Saved Threat Frame

This function shall provide for calling from the data base of a previously stored Threat Frame and causing the display of this data on the graphics screen. Call up shall be by frame identifier number or by time tag.

Advance Threat Frame

This function when actuated shall cause advance of the display picture from the Threat Frame on the screen to the next Threat Frame in time sequence.

Reset

This function when actuated shall cause the screen to be cleared of all image information and cause all graphic data output areas and buffers in the graphics processor to be reset to zero.

Call/Suppress Shooters Element
Call/Suppress Movers Element
Call/Suppress Emitters Element
Call/Suppress Map Background Element

The subroutines handling these functions shall operate in a flip-flop fashion. When the function is first actuated, the element will be displayed on the screen, superimposed on any elements already present. When the function is actuated a second time, the element will be suppressed from the screen leaving on the screen any elements previously present.

Call/Suppress Threat Frame

This function shall be handled in flip-flop fashion but in reverse from those described above. When the function is first actuated, the threat element presently on the screen will be suppressed leaving on the screen any other elements displayed. When the function is actuated a second time, the threat element will be redisplayed, superimposed on any elements already present.

Measure Distance

When this function is actuated, a subroutine shall be enabled to read successive cursor locations and compute the straight line distance between points in kilometers to an accuracy of $\pm$ 300 meters with respect to map background at a scale of 1:50,000.

Display MGR Coordinates

When this function is actuated a function will be invoked to convert screen coordinates to MGR coordinates and the MGR coordinates of the cursor identified point will be displayed in a predefined screen area.

Transfer Coordinate Location Data

When this function is actuated a subroutine will be enabled to read the cursor location, convert to MGR coordinates, and transfer this coordinate data to the data base subsystem. This function is used in conjunction with transfer of a query message (via alphameric termina') to the data base subsystem whenever the query requires identification (to the data base) of a specific symbol or other graphic location.

3.2.3.4 Graphics Support Software

DIVRAS graphics processing shall incorporate the following basic software support packages:

- Image management and image generation routines that allow the application programmer to work with the graphics processor *without requiring him to have intimate knowledge of the display* hardware or the data formats required by the hardware.

- An I/O support package that simplifies the programming interfaces between the display controller, the host computer and the data produced by the image management and image generation routines.

The capabilities to be provided in these support packages are described below. The intent in these paragraphs is to describe standard routines that in large measure are common to many commercially available graphics display software packages. Any set providing equivalent function would be satisfactory.

Support Software Overview

The software support packages shall utilize a library of subroutines to execute the functions of image management and image generation. The primary objective of these subroutines shall be to facilitate the design of application programs which need not repetitively incorporate the code for formatting and managing display elements. All the subroutines shall have standard linkages and shall be callable either from assembly language or compiler language programs with standard call statements. The routines shall be table oriented and by collecting together common parameters, shall simplify the communication between routines and reduce the amount of core storage required for parameters.

The main tables shall include:

Graphic Display Output Area. This buffer contains the data to be displayed.

Output Area Control Block. This block of storage is set aside as a central information source containing pointers to necessary data blocks and pointers.

Element Correlation Control Block. This block of storage contains the names and pointers to all the elements of data stored in the graphic display output area.

Subroutine Parameter Table. This table contains information required by image generation routines to locate and process the user data.

Screen Parameter Table. This table defines the graphic display resolution and portion of the display area the user wishes to use.

The design shall be such that the storage areas for these tables shall be established by controls carried in the application oriented programs; routines shall be available for initializing these tables.

Graphic Data Organization

The graphic data created in the graphics processing subsystem shall be generally organized into segments called elements. These segments or subdivisions shall be arbitrarily assignable and shall be addressable individually without involving the portions of the display which are outside the element's range. Provision shall be made to permit elements to be embedded within elements. The design shall permit nesting of subelements to at least 6 levels.

Image Management

Image management routines shall be designed to serve three purposes. First, they shall be used to set up tables which serve as communication links between the elements and the output routines. Second, they shall be used to generate elements and subelements by setting up an index to the area in which graphic data is stored and provide such functions as name maintenance and level search. Third, the image management routines shall provide the user with the ability to modify and delete elements that have previously been generated.

The subroutines that shall comprise the basic image management support capability shall include functions of the types itemized below:

- Initialize output area control block
- Begin element; assign element name in element correlation control block
- End element
- Suppress element from screen
- Restore element to screen
- Compress data in the graphics data output area and element correlation control block
- Add element
- Replace element
- Reallocate space for either the graphics data output area or element correlation control block
- Change element name
- Locate element name in control block hierarchy.

Image Generation

The image generation subroutines shall be used to create appropriate control words to be used in requests for the display of individual characters, lines of characters, individual vectors, and connecting vectors. It shall be the function of the image generation subroutines to take data supplied by the user and interpreted in the application programs and place it in a format that will be accepted by the system.

Tables generated by the application routines serve to pass parameters to the image generation routines. The routines shall search these tables for indication as to what is to be done with the data and for addresses of other tables necessary in subsequent processing.

The subroutines that shall comprise the basic image generation support capability shall include functions of the types itemized below:

- Initialize subroutine parameter table. Store location of the output area control block and screen parameter table.
- Store text and coordinate information in the subroutine parameter table
- Store parameters for character and line spacings in the subroutine parameter table
- Store values for indexing through the X and Y arrays (of the graphics data output area) in the subroutine parameter table
- Initialize screen parameter table. Define portion of the graphic display area to be used if an expansion or contraction of the screen image is called for.
- Compute and store scissoring parameters to control the rescaling of symbol screen positions for an expansion or contraction of the screen image.
- Store orders (instructions) for display of individual characters.
- Store order for display of a string of characters
- Generate vectors for pairs of coordinates. Control order in which segments are connected.

Input/Output Support

The input/output subroutines shall be designed to control the interchange of instructions and data between the display controller and the nost computer. The subroutines comprising this package shall include functions of the types itemized below:

- Initialize a write command table containing a channel command word for each element in the graphic data output area.

- Transfer graphic information in the graphic data output area to the display terminal to replace previous contents of the display refresh buffer.

- Transfer partial graphic information in the graphic data output area to the display to be added to the contents of the refresh buffer.

- Transfer graphic information in the graphic data output area to the display to be deleted from the refresh buffer associated with a particular display.

- Specify to the application routine the current position of the operator-controlled cursor.

- Enable keyboards at specified terminals and associate them with the user's task. Enable presentation of displays.

- Place program in wait state until specific interrupt(s) have been received or the I/O is complete.

- Disable keyboards at specified terminals and terminate displays there.

- Perform selected display control functions at a specified terminal such as setting a program function keyboard indicator.

3.3 SYSTEM PERFORMANCE/CAPACITY REQUIREMENTS

3.3.1 General Environment

The organizational/operational environment for deployment of the DIVRAS application areas shall be in accordance with current U. S. Army policies and doctrine for fieldable Division-Level tactical command and control systems as represented by the Division Tactical Operations System (TOS).

3.3.2 System Performance Parameters

The following response times, processing times and accuracies shall be required for effective implementation of the DIVRAS applications outlined in Section 3.1. Unless otherwise stated, all response time requirements shall be met or bettered at least 80 percent of the time.

3.3.2.1 Response Times at Terminals*

- General query requirements [Local Query]

a.	Response to simple query requiring retrieval of single record	4 seconds
b.	Response to query requiring search of data base to qualify n records (without summarization)	10 seconds

*NOTE: Response time = system processing time (not operator actions) and is measured from time of final operator action to initiate process until result is on display screen.

c. Response to query requiring search of data base, qualification of n records, and processing for display in specified output format. — 20 seconds

- Specified query requirements [Local Query]

a. Call stored menu/operator aid — 2 seconds
b. Call stored query format — 2 seconds
c. Call data about cursor-identified symbol (from the already qualified data set being displayed) — 4 seconds

3.3.2.2 Input Processing Requirements

- General

a. The DIVRAS targeting application shall be capable of accepting and processing targeting application messages at a peak rate of 10 per minute.

b. Concurrently, the DIVRAS maneuver application shall be capable of processing received location data and automatically updating display buffers once every 5 minutes.

The processing above shall be concurrent with normal operator/analyst terminal interactions on either of two terminals to control, display, query, and utilize the input information.

- Target Messages

  a. Targeting messages shall be taken out of the communications processing subsystem queue for processing by the application process in an average time of less than 15 seconds after receipt and validation. The maximum time shall not exceed 180 seconds.

  b. Individual targeting messages shall be processed in less than 30 seconds from the time application processing begins on that message until the analyst is alerted.

  c. Multiple target messages shall be processable concurrently.

- Shooter/Mover/Emitter Location Data

  Shooter/Mover/Emitter location data shall be processed and made available for graphic display call-up in an average time of less than 30 seconds from the time the data is received, validated, and processed in the time blocked queues by the communications processing subfunction.

3.3.2.3 Graphic Interactions

a.	Call Shooter, or Mover, or Emitter overlay	2 seconds
b.	Call stored display scene	4 seconds
c.	Store displayed scene	4 seconds
d.	Add/change/delete/move interactive symbol	2 seconds (per operation)
e.	Change scale of graphic display	6 seconds
f.	Create Unit Situation Display from ENSIT/ FRENSIT data	40 seconds

3.3.2.4 Accuracy/Resolution Requirements

- Accuracy of locating a point on display screen with cursor at 1:50,000 scale for query or symbol placement. ±150 meters

APPENDIX I. MESSAGE FORMATS

This appendix details the formats indicated for all message types on Figure 3.1.1-4 of paragraph 3.1.1. The circled letter of each format statement or description contained in this appendix refers to that indicated in Figure 3.1.1-4.

(A) This format represents a general SOTAS input form to DIVRAS. The elements of this message are indicated in Figure I-1 and further identified in the data field glossary of this appendix. In certain instances, such as certain query responses, multiple targets are involved. In this case repetition of the necessary information elements in the response message may be appropriate.

(B) This format represents a query or standing information request for Division SIGINT Sources or a query, standing track request, or specific track update request for SOTAS. The elements of this message are indicated in Figure I-2 and further identified in the data field glossary of this appendix.

For standing requests for target reporting, it is implied that the DIVRAS analyst can select area(s), target type/characteristics and quantity thresholds. The time interval in these cases represents the length of time the analyst wishes this standing request to be outstanding. (There can be more than one outstanding at any one time.) The target reference number(s) in these cases is unused and the Query/Request number identifies this request as a standing request.

For query, it is implied that similar criteria bound the query. In these cases, the time interval (DTG and span) bound the historical

X 4 A/N	Ø 4 A/N	X 6 A/N	X 11 A/N	X 2 A/N
MESSAGE TYPE	QUERY REQUEST NUMBER	TRACK #	EVENT DATE/TIME	DIRECT REPORT

REQUIRED ON ALL QUERY RESPONSES FROM SOTAS (MESSAGE TYPE S01)

X 6 A/N	I 7 A/N	X 8 A/N	Ø 3 A	Ø 3 N	Ø 5 N
TYPE/SUBJECT	TARGET CATEGORY	LOCATION	DIR	VEL	QTY

I 18 A/N	I 18 A/N	30 A/N
TRACK ORIGIN	TRACK DESTINATION	REMARKS

LEGEND:

X - REQUIRED
Ø - OPTIONAL
I - INFERRED

FIGURE I-1. REPRESENTATIVE SOTAS TRACK FORMAT

MESSAGE TYPE	QUERY/ REQUEST NUMBER	TARGET (TRACK) REFERENCE NUMBER(S) OF INTEREST
AREA(S) OF INTEREST (NAMED AREA(S) OR SPECIFIED CIRCLE CENTERS AND RADII)		TIME INTERVAL OF INTEREST (DTG PLUS PERIOD SPAN IN MINUTES)
QUANTITY THRESHOLD OF INTEREST	TARGET TYPE/SUBTYPE/CHARACTERISTICS OF INTEREST	

FIGURE I-2. REPRESENTATIVE QUERY/SRI/SPECIFIC TRACK UPDATE REQUEST FOR SOTAS AND DIVISION SIGINT INTERFACES

window for the query. The query/request number identifies this as a query and further is included in the response message for relinkage with the query in DIVRAS. Again the target (track) reference number is unused.

For a specific track update request, the query/request number identifies it as such. The target (track) reference number(s) indicate the track(s) on which update is requested. The time interval is the future time span during which periodic update is automatically required. The remaining fields are not used.

(C) This format represents a general command guidance format for the SOTAS and Division SIGINT Sources. The elements of this message are indicated in Figure I-3 and further identified in the data field glossary of this appendix.

For direct reporting command guidance, the command guidance (DR or GEOM) field so indicates. In this case the node for direct reporting, the criteria, and the future time span for the direct reporting to take place are identified. More than one such direct reporting command guidance message may be outstanding at any one time.

For other command guidance (namely battlefield situation/geometry descriptions which better enhance and coordinate the sensor ground station's interpretation of received data), the free text portion is used and assumes operator interpretation for use at the ground station before influencing the ground station system operation.

(D) This format represents a general photint/sigint target format for reporting analyzed emitter/photo target data to DIVRAS from Division SIGINT Sources as well as Corps photointelligence or

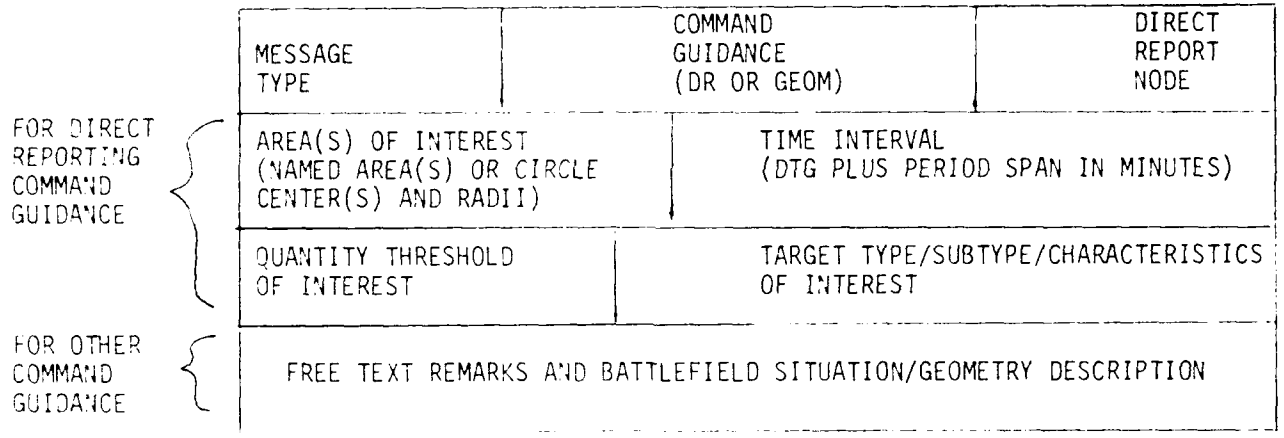


FIGURE I-3. COMMAND GUIDANCE MESSAGE FOR SOTAS AND DIVISION SIGINT SOURCES

SIGINT sources. The elements reported are indicated in Figure I-4 and are further identified in the data field glossary of this appendix.

(E) This format represents a time grouped (bulk) message containing detected target locations transmitted periodically to DIVRAS from Division SIGINT Sources, CORPS SIGINT sources and TACFIRE. Figure I-5 indicates the message elements of the bulk message which are further identified in the data field glossary. Each line element contains a simple alpha code indicating the type of location the line element identifies the coordinate of the sighting and, if known (as is possible in the case of TACFIRE shooter or mover location data), the estimated number of vehicles or shooters.

(F G H I J K L M N P)

These formats are the existing TACFIRE formats as defined for that system.

(Q R S T U V)

These formats are the existing TOS Operable Segment formats as defined for that concept validation test bed system.

DATA FIELD GLOSSARY

The data fields are listed in the sequence they are encountered in Figures I-1 through I-5.

- Message Type - an alphanumeric code that identifies the external node and generic class of information contained in the message.

REQUIRED ON ALL QUERY RESPONSES FROM DIVISION SIGINT (MESSAGE TYPE CA1)

X 4 A/N	4 A/N	X 6 A/N	X 11 A/N	X 2 A/N
MESSAGE TYPE	QUERY REQUEST NUMBER	TARGET REFERENCE NUMBER	EVENT DATE/TIME	DIRECT REPORT

X 6 A/N	I 7 A/N	X 8 A/N	O 10 A/N	O 26 A/N	O 3 N
TYPE/SUBJECT	TARGET CATEGORY	LOCATION	TARGET CHARACTERISTICS	ENEMY UNIT IDENTIFICATION	LOCATION ERROR

O 60 A/N - ELINT/PHOTINT 100 A/N - COMINT
REMARKS

LEGEND:

X - REQUIRED
O - OPTIONAL
I - INFERRED

FIGURE I-4. REPRESENTATIVE PHOTINT/SIGINT TARGET FORMAT

MESSAGE FORMAT	TIME INTERVAL REPORTED DATE/TIME 1 DATE TIME 2
TYPE CODE	LOCATION AND NUMBER 17 A/N
TYPE CODE	LOCATION AND NUMBER
1 A	
TYPE CODE	LOCATION AND NUMBER

TYPE CODE IS

R - RADAR EMITTER
C - COMMUNICATIONS EMITTER
M - MOVER
S - SHOOTER

FIGURE I-5. REPRESENTATIVE EMITTER LOCATION DATA FORMAT TO SUPPORT MANEUVER DISPLAY

- Query/Request Number - a message numbering used for uniquely matching external nodal responses and DIVRAS requests for information.

- Target Reference (or Track) Number - a numbering system attached to a target or track by its originating node which uniquely identifies targets originated by that node (i.e. QSTAG 221).

- Event Date/Time - the date and time of the event being reported (in DTG format).

- Direct Report - indicates that the message has been directly reported to a weapon node in accordance with currently outstanding guidance for direct reporting. For DIVRAS purposes, it will be data based as target data but not processed as a target of possible incoming interest.

- Type/Subject - subject which the message is about or identification of a target type.

- Target Category - a group or class of target subjects.

- Location - specific location, in military grid reference (MGR) coordinates, of subject or target type being reported.

- Direction - for moving targets, it indicates the direction of movement of the target as a compass bearing (e.g. SSW - south by southwest).

- Velocity - indicates the rate of movement of the target being reported in kilometers per hour.

- Quantity - an estimate of target quantity where appropriate.

- Track Origin - specific location, in military grid reference (MGR) coordinates, at which a moving target was initially detected.

- Track Destination - specific location, in military grid reference (MGR) coordinates, at which a moving target track is estimated to be heading.

- Area(s) of Interest - named area(s) or specified circle centers and radii.

- Time Interval of Interest - a time interval which can identify historical time of interest for a query, or command guidance, standing request, or specific track request effective time span.

- Quantity Threshold of Interest - criteria threshold for target reporting.

- Command Guidance - indicates whether the message is concerned with specifying direct reporting instructions or describing battlefield situation geometry.

- Direct Report Node - specifies the weapon node to whom the sensor node is instructed to report specified targets, under this guidance message. (More than one such command guidance message may be outstanding at one time.)

- Target Characteristics - a detail characteristic describing a target (a hierarchical level of target description includes category - type/subject - characteristic).

- Enemy Unit Identification - a name or description to identify a specific enemy unit (e.g. 64 Tank Regiment) where possible.

- Location Error - Circular Error Probability (CEP) in the reported target location, measured in meters.

- Type Code - this code is used with the bulk message to identify detections as shooters, movers, radars or radios.

APPENDIX II. FILE FORMAT TABLE/DATA ELEMENT DEFINITION

This appendix describes a representative file format table for a two level structured record containing a fixed information set and multiple periodic information sets as described in paragraph 3.2.2. For any given periodic set, there can be as many repetitions as desired. This feature permits assignment of multiple information items within a periodic category of a record (such as multiple target periodic sets associated with an enemy unit record or target history sets associated with a target record).

The basic file format table (Table II-1) embodies the definitions indicated in the column headings of the table. The set number identifies the fixed or periodic set format. Those included in this table are:

Set 000 - Fixed Set Data
Set 001 - Polygon Coordinate Information
Set 002 - Friendly/Enemy Unit Data
Set 003 - Target Data
Set 004 - Friendly Unit Equipment Data
Set 005 - Friendly Unit Personnel Data
Set 006 - Friendly Unit Critical Supply Data
Set 007 - Remarks Data

The field size, mode, and label provide the data element definition. For example, each repeated polygon periodic set would contain a two (size) alphanumeric (mode) character coded polygon name and a three (size) alphanumeric (mode) character area type definition. The polygons themselves would be defined by a string of up to eight coordinate fields each containing up to 15 characters for definition of the coordinate.

***** TABLE II-1. EXAMPLE FILE FORMAT *****

SHEET 1 OF 5

FLD/GRP NAME	STATEMENT OPERATOR	FIELD SIZE	SPEC USE	SET NO.	RET. LOGIC	MODE	INPUT SUBRT	OUTPUT SUBRT	EDIT NAME	FIELD/GROUP/VAR.SET LABEL (CHARS 1-60)	THE FLAG ** MARKS NOTE STATEMENTS
RTYPE	FIELD	001	CTL	000	-	ALPHA	---	---	---		
										** C = CONTROL.	
										** E = ENEMY.	
										** F = FRIENDLY.	
RECID	FIELD	013	CTL	000	-	ALPHA	---	---	---		
										** TARGET/TRACK REFERENCE NUMBER.	
										** UNIT SHORT NAME.	
										** ORIGNATOR NUMBER.	
RECTL	GROUP	*	---	---	-	ALPHA	---	---	---		
		* FIELDS- RTYPE RECID									
QTY	FIELD	005	---	000	-	NUMER	---	---	---		
DAREA	FIELD	002	---	000	-	ALPHA	---	---	---		
										** NAMED AREA DESIGNATION POINT.	
CAREA	FIELD	002	---	000	-	ALPHA	---	---	---		
										** NAMED AREA DESTINATION POINT.	
TIME	FIELD	003	---	000	-	NUMER	---	---	---		
										** TRACK MOVEMENT TIME IN MINUTES.	
DIST	FIELD	005	---	000	-	NUMER	---	---	---		
										** TRACK DISTANCE IN KM.	
FLAG1	FIELD	001	---	000	-	ALPHA	---	---	---		
FLAG2	FIELD	001	---	000	-	ALPHA	---	---	---		
FLAG3	FIELD	001	---	000	-	ALPHA	---	---	---		
FLAG4	FIELD	001	---	000	-	ALPHA	---	---	---		
FLAG5	FIELD	001	---	000	-	ALPHA	---	---	---		
FLAG6	FIELD	001	---	000	-	ALPHA	---	---	---		
										**	
										** ********** PERIODIC SET 1 **********.	
										** THIS SET CONTAINS COORDINATE INFORMATION FOR	
										** POLYGONS	
										**	
CNAME	FIELD	002	CTL	001	-	ALPHA	---	---	---		
										** SPECIFIC NAME OF POLYGON.	
CTYPE	FIELD	001	CTL	001	-	ALPHA	---	---	---		
										** TYPE OF AREA (NZE, FEH, FZE).	
AREAID	GROUP	*	---	---	-	ALPHA	---	---	---		
		* FIELDS- CNAME CTYPE									
COORD1	FIELD	015	---	001	-	COORD	---	---	---		
COORD2	FIELD	015	---	001	-	COORD	---	---	---		
LINE	GROUP	*	---	---	-	COORD	---	---	---		
		* FIELDS- COORD1 COORD2									
COORD3	FIELD	015	---	001	-	COORD	---	---	---		
COORD4	FIELD	015	---	001	-	COORD	---	---	---		
COORD5	FIELD	015	---	001	-	COORD	---	---	---		
COORD6	FIELD	015	---	001	-	COORD	---	---	---		
COORD7	FIELD	015	---	001	-	COORD	---	---	---		
COORD8	FIELD	015	---	001	-	COORD	---	---	---		
AREA	GROUP	*	---	---	-	COORD	---	---	---		
		* FIELDS- COORD1 COORD2 COORD3 COORD4 COORD5 COORD6 COORD7 COORD8									
										**	
										** ********** PERIODIC SET 2 **********.	
										** THE FOLLOWING SET CONTAINS DATA ON FRIENDLY TROOPS IN MY UNIT	
										**	
UNIT	FIELD	026	---	002	-	ALPHA	---	---	---		
										** UNIT NAME.	
UTYPE	FIELD	004	---	002	-	ALPHA	---	---	---		
UMSG	FIELD	004	---	002	-	ALPHA	---	---	---		
UYR	FIELD	002	---	002	-	ALPHA	---	---	---		
UMO	FIELD	002	---	002	-	ALPHA	---	---	---		

***** TABLE II-1. EXAMPLE FILE FORMAT *****

SHEET 2 OF 5

FLD/GRP NAME	STATEMENT OPERATOR	FIELD SIZE	SPEC USE	SET NO.	RET. LOGIC	MODE	INPUT SUBRT	OUTPUT SUBRT	EDIT NAME	FIELD/GROUP/VAR.SET LABEL (CHARS 1-60)	THE FLAG ** MARKS NOTE STATEMENTS
UDA	FIELD	002	---	002	-	ALPHA	---	---	---		
UDATE	GROUP	*	---	---	-	ALPHA	---	---	---		
		* FIELDS-		UYR		UMO	UDA				
										** YYMMDD.	
UTIME	FIELD	004	---	002	-	ALPHA	---	---	---		
UDT	GROUP	*	---	---	-	ALPHA	---	---	---		
		* FIELDS-		UDA		UTIME					
										** DDTTTT.	
UMDT	GROUP	*	---	---	-	ALPHA	---	---	---		
		* FIELDS-		UMO		UDT					
										** MMDDTTTT.	
UDTG	GROUP	*	---	---	-	ALPHA	---	---	---		
		* FIELDS-		UDATE		UTIME					
										** YYMMDDTTTT.	
UZONE	FIELD	001	---	002	-	ALPHA	---	---	---		
UTZ	GROUP	*	---	---	-	ALPHA	---	---	---		
		* FIELDS-		UDTG		UZONE					
										** YYMMDDTTTTZ.	
UCTIME	FIELD	01R	---	002	-	ALPHA	---	---	---		
										** CURRENT TIME AS MMDDTTTT.	
PARENT	FIELD	026	---	002	-	ALPHA	---	---	---		
DEPLOY	FIELD	002	---	002	-	ALPHA	---	---	---		
COMBAT	FIELD	003	---	002	-	NUMER	---	---	---		
										** COMBAT POWER = PERCENTAGE.	
UMGR	FIELD	009	---	002	-	ALPHA	---	---	---		
ULOC	FIELD	015	---	002	-	COORD	---	---	---		
AFSVC	FIELD	001	---	002	-	ALPHA	---	---	---		
SUBTO	FIELD	020	---	002	-	ALPHA	---	---	---		
										** SUBORDINATE TO.	
SUBTYPE	FIELD	007	---	002	-	ALPHA	---	---	---		
UACT	FIELD	006	---	002	-	ALPHA	---	---	---		
NATION	FIELD	002	---	002	-	ALPHA	---	---	---		
SNODARD	FIELD	020	---	002	-	ALPHA	---	---	---		
UAGENCY	FIELD	005	---	002	-	ALPHA	---	---	---		
UORIGND	FIELD	010	---	002	-	ALPHA	---	---	---		
UDET1	FIELD	002	---	002	-	ALPHA	---	---	---		
UDET2	FIELD	002	---	002	-	ALPHA	---	---	---		
UDETECT	GROUP	*	---	---	-	ALPHA	---	---	---		
		* FIELDS-		UDET1		UDET2					
UREL1B	FIELD	002	---	002	-	ALPHA	---	---	---		
UORIGR	FIELD	001	---	002	-	ALPHA	---	---	---		
ULAST	FIELD	001	---	002	-	ALPHA	---	---	---		
UFLAG1	FIELD	001	---	002	-	ALPHA	---	---	---		
UFLAG2	FIELD	001	---	002	-	ALPHA	---	---	---		
UFLAG3	FIELD	001	---	002	-	ALPHA	---	---	---		
										**	
										** ********** PERIODIC SET 3 **********.	
										** THE FOLLOWING SET CONTAINS DATA ON ENEMY TRACK/TARGET DA	
										**	
TGTREF	FIELD	026	---	003	-	ALPHA	---	---	---		
TYR	FIELD	002	---	003	-	ALPHA	---	---	---		
TMO	FIELD	002	---	003	-	ALPHA	---	---	---		
TDA	FIELD	002	---	003	-	ALPHA	---	---	---		
TDATE	GROUP	*	---	---	-	ALPHA	---	---	---		
		* FIELDS-		TYR		TMO	TDA				
										** YYMMDD.	
TTIME	FIELD	004	---	003	-	ALPHA	---	---	---		
TDT	GROUP	*	---	---	-	ALPHA	---	---	---		
		* FIELDS-		TDA		TTIME					
										** DDTTTT.	

***** TABLE II-1. EXAMPLE FILE FORMAT *****

SHEET 3 OF 5

FLD/GRP NAME	STATEMENT OPERATOR	FIELD SIZE	SPEC USE	SET NO.	RET. LOGIC	MODE	INPUT SUBRT	OUTPUT SUBRT	EDIT NAME	FIELD/GROUP/VAR.SET LABEL (CHARS 1-20)	THE FLAG ** MARKS NOTE STATEMENTS
TMDT	GROUP	*	---	---	-	ALPHA	---	---	---		
		* FIELDS- TMD TDT									
										** MMDDTTTT.	
TDTG	GROUP	*	---	---	-	ALPHA	---	---	---		
		* FIELDS- TDATE TTIME									
										** YYMMDDTTTT.	
TZONE	FIELD	001	---	003	-	ALPHA	---	---	---		
TTZ	GROUP	*	---	---	-	ALPHA	---	---	---		
		* FIELDS- TDTG TZONE									
										** YYMMDDTTTTZ.	
TCTIME	FIELD	009	---	003	-	ALPHA	---	---	---		
										** CURRENT TIME AS MMDDTTTT.	
DDFLAG	FIELD	002	---	003	-	ALPHA	---	---	---		
TMSG	FIELD	004	---	003	-	ALPHA	---	---	---		
TCAT1	FIELD	002	---	003	-	ALPHA	---	---	---		
TCAT2	FIELD	002	---	003	-	ALPHA	---	---	---		
TCAT	GROUP	*	---	---	-	ALPHA	---	---	---		
		* FIELDS- TCAT1 TCAT2									
TEST2	GROUP	*	---	---	-	ALPHA	---	---	---		
		* FIELDS- TMSG TCAT									
ODFLAG	FIELD	001	---	003	-	ALPHA	---	---	---		
										** O = ORIGINATION POINT, D = DESTINATION POINT.	
TQTY	FIELD	005	---	003	-	NUMER	---	---	---		
										** QUANTITY OF SUBJECT UNITS.	
TLAST	FIELD	001	---	003	-	ALPHA	---	---	---		
										** LATEST MESSAGE FLAG.	
TUNIT	FIELD	001	---	003	-	ALPHA	---	---	---		
										** TARGETED UNIT FLAG.	
MOBILE	FIELD	002	---	003	-	ALPHA	---	---	---		
HARD	FIELD	002	---	003	-	ALPHA	---	---	---		
OMGR	FIELD	006	---	003	-	ALPHA	---	---	---		
DMGR	FIELD	009	---	003	-	ALPHA	---	---	---		
DIRECT	FIELD	003	---	003	-	ALPHA	---	---	---		
SPEED	FIELD	003	---	003	-	NUMER	---	---	---		
PERM	FIELD	003	---	003	-	NUMER	---	---	---		
										** IN MINUTES.	
TCHAR	FIELD	010	---	003	-	ALPHA	---	---	---		
CONFIRM	FIELD	003	---	003	-	ALPHA	---	---	---		
										** CONF, NOT, UNK.	
ENGAGE	FIELD	003	---	003	-	ALPHA	---	---	---		
DET1	FIELD	002	---	003	-	ALPHA	---	---	---		
DET2	FIELD	002	---	003	-	ALPHA	---	---	---		
DETECT	GROUP	*	---	---	-	ALPHA	---	---	---		
		* FIELDS- DET1 DET2									
TEST	GROUP	*	---	---	-	ALPHA	---	---	---		
		* FIELDS- TCAT DETECT									
AGENCY	FIELD	005	---	003	-	ALPHA	---	---	---		
TEST1	GROUP	*	---	---	-	ALPHA	---	---	---		
		* FIELDS- TCAT DETECT AGENCY									
TWIDTH	FIELD	002	---	003	-	ALPHA	---	---	---		
LENGTH	FIELD	004	---	003	-	NUMER	---	---	---		
										** IN METERS.	
TRKNO	FIELD	010	---	003	-	ALPHA	---	---	---		
TARGET	FIELD	001	---	003	-	ALPHA	---	---	---		
FILLB	FIELD	002	---	003	-	ALPHA	---	---	---		
DETOR	FIELD	001	---	003	-	ALPHA	---	---	---		
SUBJECT	FIELD	006	---	003	-	ALPHA	---	---	---		
ACTIVE	FIELD	006	---	003	-	ALPHA	---	---	---		
TMGR	FIELD	004	---	001	-	ALPHA	---	---	---		
TLOC	FIELD	015	---	003	-	COORD	---	---	---		

***** TABLE II-1. EXAMPLE FILE FORMAT *****

SHEET 4 OF 5

FLD/GRP NAME	STATEMENT OPERATOR	FIELD SIZE	SPEC USE	SET NO.	RET. LOGIC	MODE	INPUT SUBRT	OUTPUT SUBRT	EDIT NAME	FIELD/GROUP/VAR.SET LABEL (CHARS 1-60)	THE FLAG ** MARKS NOTE STATEMENTS
										** ENG, NEN, UNK.	
WEAPON	FIELD	002	---	003	-	ALPHA	---	---	---	** TF, TA, AA.	
DESTROY	FIELD	003	---	003	-	ALPHA	---	---	---	** CONFIRMED DESTRUCT REQUIRED.	
										** YES, NO , UNK.	
AIRDEF	FIELD	002	---	003	-	ALPHA	---	---	---	** HV, LT.	
OBSERV	FIELD	003	---	003	-	ALPHA	---	---	---	** A, G, A/G.	
HVALUE	FIELD	001	---	003	-	ALPHA	---	---	---		
TFLAG1	FIELD	001	---	003	-	ALPHA	---	---	---		
TFLAG2	FIELD	001	---	003	-	ALPHA	---	---	---		
TFLAG3	FIELD	001	---	003	-	ALPHA	---	---	---		
TFLAG4	FIELD	001	---	003	-	ALPHA	---	---	---		
TFLAG5	FIELD	001	---	003	-	ALPHA	---	---	---		
										**	
										** ********** PERIODIC SET 4 **********.	
										** THIS SET CONTAINS FRIENDLY EQUIPMENT DATA.	
										**	
EQUIP	FIELD	006	CTL	004	-	ALPHA	---	---	---	** EQUIPMENT TYPE REF APP D-11.	
EQAVAIL	FIELD	003	---	004	-	NUMER	---	---	---	** QUANTITY AVAILABLE.	
EQAUTH	FIELD	003	---	004	-	NUMER	---	---	---	** QUANTITY AUTHORIZED.	
EQTIME	FIELD	011	---	004	-	ALPHA	---	---	---	** DTG OF EQUIPMENT STATUS AS YYMMDDTTTTZ.	
EMSG	FIELD	011	---	004	-	ALPHA	---	---	---	** ORIG/NO OF MSG REPORTING EQUIPMENT STATUS.	
										**	
										** ********** PERIODIC SET 5 **********.	
										** THE FOLLOWING SET CONTAINS FRIENDLY PERSONNEL DATA.	
										**	
OFFICER	FIELD	004	---	005	-	NUMER	---	---	---	** OFFICERS AVAILABLE.	
NCO	FIELD	004	---	005	-	NUMER	---	---	---	** NCO AVAILABLE.	
EM	FIELD	005	---	005	-	NUMER	---	---	---	** ENLISTED MEN AVAILABLE.	
OFFAUTH	FIELD	004	---	005	-	NUMER	---	---	---	** OFFICERS AUTHORIZED.	
NCOAUTH	FIELD	004	---	005	-	NUMER	---	---	---	** NCO AUTHORIZED.	
EMAUTH	FIELD	005	---	005	-	NUMER	---	---	---	** ENLISTED MEN AUTHORIZED.	
FORCES	GROUP	*	---	---	-	NUMER	---	---	---		
		* FIELDS=		OFFICER	NCO	EM		OFFAUTH	NCOAUTH	EMAUTH	
PTIME	FIELD	011	---	005	-	ALPHA	---	---	---	** DTG OF PERSONNEL DATA AS YYMMDDTTTTZ.	
PMSG	FIELD	011	---	005	-	ALPHA	---	---	---	** ORIG/NO OF MSG REPORTING PERSONNEL.	
										**	
										** ********** PERIODIC SET 6 **********.	
										** THE FOLLOWING SET CONTAINS DATA ON CRITICAL SUPPLIES.	
										**	
SUPPLY	FIELD	006	CTL	006	-	ALPHA	---	---	---	** TYPE OF CRITICAL SUPPLY.	
										** AMMO.	
										** TA-4AM.	

***** TABLE II-1. EXAMPLE FILE FORMAT *****

SHEET 5 OF 5

FLD/GRP NAME	STATEMENT OPERATOR	FIELD SIZE	SPEC USE	SET NO.	RET. LOGIC	MODE	INPUT SUBRT	OUTPUT SUBRT	EDIT NAME	FIELD/GROUP/VAR.SET LABEL (CHARS 1-60)	THE FLAG ** MARKS NOTE STATEMENTS
										** JP4.	
										** MORTAR.	
										** DIESEL.	
										** FOOD.	
										** ARTILL.	
										** GAS.	
										** WATER.	
PERAVAL	FIELD	003	---	006	-	NUMER	---	---	---		
										** PERCENT OF SUPPLY AVAILABLE.	
CBTAVAL	FIELD	007	---	006	-	NUMER	---	---	---		
										** COMBAT AVAILABILITY OF SUPPLY.	
STIME	FIELD	011	---	006	-	ALPHA	---	---	---		
										** DTG OF MSG CONCERNING CRITICAL SUPPLIES AS YYMMDDTTTTZ.	
SMSG	FIELD	011	---	006	-	ALPHA	---	---			
										** ORIG/NO OF MSG REPORTING SUPPLIES	
										** PERIODIC SET 7	
										** ******THE FOLLOWING SET CONTAINS REMARKS DATA******.	
										**	
RTIME	FIELD	011	CTL	007	-	ALPHA	---	---	---		
RMSG	FIELD	011	---	007	-	ALPHA	---	---	---		
REMARK	FIELD	072	---	007	-	ALPHA	---	---	---		

APPENDIX III. INFERENCE RULES

The DIVRAS system provides the functional ability to infer selected target report fields from the data contained in other fields of the same target report. Inference processing is provided for the key target parameters of:

1. Target category
2. Target worth
3. Method of detection
4. Target permanence
5. Target location error

Tables III-1 through III-3 indicate a representative inference rule set for the first three above.

For target category each incoming report can pick up to two categories as they are first encountered processing on the stated fields (columns) in a sequential top down manner.

For target worth the maximum worth number encountered is assigned after processing the entire list from top to bottom.

TABLE III-1

INFERENCE - TARGET CATEGORY

MSG FORMAT TYPE	TYPE (CONTAINS)	TARGET CHARACTERISTICS	TARGET CATEGORY (ENTER UP TO 2)
S02			CONCENTRATION (AS WELL AS TRACK ORIGIN ON FIRST OCCURANCE OF TRACK)
S04			
DA4C			
S03			TRACK LOSS
S05			"
	ASSEMBLY		ASSEMBLY AREA
	ASSEMBLY AREA		"
	CP/C2		CP/C2
	CP		"
	C2		"
	MICROWAVE		"
	SUPPLY/CS		SUPPLY/CS
	SUPPLY POINT		"
	HELIPAD		"
	CANNON		ARTILLERY
	ARTILLERY		"
	MORTAR		"
	HOWITZER		"
	SP ARTY		"
	RL		"
	MRL		"
	BTRY		"
	ARTY		"

TABLE III-1 (CONTINUED)

MSG FORMAT TYPE	TYPE (CONTAINS)	TARGET CHARACTERISTICS	TARGET CATEGORY (ENTER UP TO 2)
	MET RADAR		MET RADAR
		BREAD BIN	"
		END TRAY	"
	ROCKET/MISSILE		ROCKET/MISSILE
	ROCKET LAUNCHER		"
	SSM		"
	FROG LAUNCHER		"
	SAM		SAM RADAR/SAM
	SAM RADAR		"
		FIRE CAN	"
		FLAT FACE	"
		THIN SKIN	"
		STRAIGHT FLUSH	"
		LONG TRACK	"
		SA-6	"
		SA-9	"
	CFR		CF/GSR RADAR
	GSR		"
	CF RADAR		"
	GS RADAR		"
		PORK TROUGH	"
		SMALL YAWN	"

TABLE III-2. INFERENCE - TARGET WORTH

MSG FORMAT TYPE	TYPE	QTY	TARGET CATEGORY CONTAINS	TARGET CHARACTERISTICS	EN UNIT (CONTAINS)	TARGET WORTH (ENTER HIGHEST #)
DA4a						10
DA4b						10
DA4c						10
DA4c		>4				30
DA4c		>9				50
SO2						10
SO2		>4				30
SO2		>9				50
SO3						10
SO3		>4				30
SO3		>9				50
SO4						10
SO4		>4				30
SO4		>9				50
SO5						10
SO5		>4				30
SO5		>9				50
SO6						10
OA2						10

TABLE III-2 (CONTINUED)

MSG FORMAT TYPE	TYPE	QTY	TARGET CATEGORY CONTAINS	TARGET CHARACTERISTICS	EN UNIT (CONTAINS)	TARGET WORTH (ENTER HIGHEST #)
CA3						10
CA4						10
CA5						10
C04a						10
C04b						10
C05a						10
C05b						10
C06a						10
C06b						10
C07a						10
C07b						10
	DIVISION CP					50
	DIVARTY CP					50
	CORPS CP					50
	REGIMENT CP					30
	CP					30
	ROCKET/MISSILE					50
	SSM					50
	SAM					50
	FROG LAUNCHER					50

TABLE III-2 (CONTINUED)

MSG FORMAT TYPE	TYPE	QTY	TARGET CATEGORY CONTAINS	TARGET CHARACTERISTICS	EN UNIT (CONTAINS)	TARGET WORTH (ENTER HIGHEST #)
	CF RADAR					30
	GS RADAR					30
	MET RADAR					30
	SAM RADAR					50
	RADAR					30
	RADIO					10
	MICROWAVE					50
	EMITTER					10
	ROCKET					30
	LAUNCHER					30
	CANNON					30
	ARTILLERY					30
	MORTAR					30
	HOWITZER					30
	HELICOPTER					30
	POL					50
	BRIDGE					50
	MUNITIONS					50
	ASSEMBLY					50

TABLE III-2 (CONTINUED)

MSG FORMAT TYPE	TYPE	QTY	TARGET CATEGORY CONTAINS	TARGET CHARACTERISTICS	EN UNIT (CONTAINS)	TARGET WORTH (ENTER HIGHEST #)
	SUPPLY POINT					50
	HELIPAD					50
	STRONG POINT					10
	BLOCKING POINT					10
	REVETMENT					10
	VEHICLE					10
	VEHICLE	>4				30
	APC					10
	APC	>4				30
	TANK					10
	TANK	>4				30
	SP ARTY					10
	SP ARTY	>4				30
	TRUCK					10
	TRUCK	>4				30
	TARGET					10
	DIV CP					50
	REGT CP					30
	FROG					50

TABLE III-2 (CONTINUED)

MSG FORMAT TYPE	TYPE	QTY	TARGET CATEGORY CONTAINS	TARGET CHARACTERISTICS	EN UNIT (CONTAINS)	TARGET WORTH (ENTER HIGHEST #)
	CFR					30
	GSR					30
	ARTY					30
	HOW					30
	HELO					30
	SUPPLY PT					50
	STRONG PT					10
	BLOCK PT					10
	RL					30
	MRL					30
	BTRY					30
	C2					50
			SAM RADAR/SAM			50
			ARTILLERY			30
			MET RADAR			30
			CF/GSR RADAR			30
			ASSEMBLY AREA			30
			CONCENTRATION			30
			CP/C2			50

TABLE III-2 (CONTINUED)

MSG FORMAT TYPE	TYPE	QTY	TARGET CATEGORY CONTAINS	TARGET CHARACTERISTICS	EN UNIT (CONTAINS)	TARGET WORTH (ENTER HIGHEST #)
			SUPPLY/CS			50
			TRACK LOSS			10
			TRACK ORIGINS			10
			ROCKET/MISSILE			50
				SA-6		50
				SA-7		30
				SA-9		30
				BREAD BIN		50
				PORK TROUGH		30
				SMALL YAWN		30
				FIRE CAN		30
				FLAT FACE		30
				THIN SKIN		30
				POLE DISK		30
				END TRAY		30
				STRAIGHT FLUSH		50
				LONG TRACK		50
					FROG BN	50
					ARTY	30

TABLE III-2 (CONTINUED)

MSG FORMAT TYPE	TYPE	QTY	TARGET CATEGORY CONTAINS	TARGET CHARACTERISTICS	EN UNIT (CONTAINS)	TARGET WORTH (ENTER HIGHEST #)
					FA	30
					AAA	30
					BTRY	30

TABLE III-3. INFERENCE - METHOD OF DETECTION

MSG FORMAT TYPE	METHOD OF DETECTION (UP TO 2 ENTRIES)
SO2	MTIR
SO3	"
SO4	"
SO5	"
SO6	"
DA4c	PHOTINT
CO4a	"
CO5a	"
CO6a	"
CO7a	COMINT/COMINT DF
CA2	"
CA3	"
CA5	"
CO4b	"
CO5b	"
CO7b	"
CA4	ELINT
CO6b	"

APPENDIX IV. INPUT MESSAGE RATES

Figure IV-1 is a detailed analysis of the DIVRAS message input rates from each communication source indicated in Section 3.1.1. It categorizes the messages (detections) as shooter, mover or emitter and identifies the sensor source supplying the data. The items marked N.A. (not applicable) mean that the identified communication line does not support that application. For example, the Corps Target Team-DIVRAS communication line does not support the maneuver application but does support the targeting application.

For both the maneuver and targeting application, the columns titled "Average Detections per Hour", "Detections in Highest Volume Hour", and "Target Reports per Highest Volume Hour" summarize the message and detection rates used to drive the DIVRAS Experimentation Scenario (see DIVRAS Final Report, Aug. 3, 1977). In these scenarios, a mathematical model was used to direct the friendly surveillance sensor systems against the enemy target model and generate the target messages and detections.

The columns labeled "Peak Load Detections per Hour" and "Peak Load Target Reports per Hour" have been determined by taking the detections and reports in the highest volume hour, for each sensor and increasing them by 33 per cent.

For the maneuver application, it was assumed that five minutes of detections would be accumulated at each node and then sent as a burst message to DIVRAS. The peak load detections in five minutes per sensor was therefor determined by dividing the peak load detections per hour by twelve.

The number of bytes per communication line was determined from the message length defined in Figure IV-2. These lengths were, in turn, determined from the message formats defined in Appendix I.

COMMUNICATION LINE IDENTIFICATION	CATEGORY	SENSOR SOURCE	MANEUVER APPLICATION						TARGETING APPLICATION		
			AVERAGE DETECTIONS PER HOUR	DETECTIONS IN HIGHEST VOLUME HR	PEAK LOAD DETECTIONS PER HOUR	PEAK LOAD DETECTIONS IN 5 MINUTES: PER SENSOR	PER COMM LINK	BYTES PER COMM LINE	TARGET REPORTS PER HIGHEST VOLUME HOUR	PEAK LOAD TARGET REPORTS PER HOUR	BYTES PER PEAK HOUR PER COMM LINE
QUICK LOOK CPC - DIVRAS	EMITTER RADAR	QUICK LOOK	5	5	7	1	1	53	5	7	1,260
CORPS TARGET TEAM - DIV RS	SHOOTER/ MOVER	MAGIIC (OV-1)	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	112	150	43,340
	EMITTER RADIO	GUARDRAIL	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	35	47 / 197	
GUARDRAIL CPC - DIVRAS	EMITTER RADIO	GUARDRAIL	114	501	665	55	55	1,025	N.A.	N.A.	N.A.
TEAM PACK CPC - DIVRAS	EMITTER RADAR	TEAM PACK	11	11	15	1	1	53	11	15	2,700
DIVISION ALL SOURCE - DIVRAS	EMITTER RADIO	TRAILBLAZER	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	30	40	8,600
TRAILBLAZER CPC - DIVRAS	EMITTER RADIO	TRAILBLAZER	756	756	1,000	83	83	1,529	N.A.	N.A.	N.A.
SOTAS SENSOR STATION - DIVRAS	MOVER	SOTAS	35	50	66	N.A. SOTAS DETECTIONS ARE HANDLED AS INDIVIDUAL MESSAGE, SAME AS TARGETING.	N.A.	N.A.	50	66	10,560
TACFIRE - DIVRAS	MOVER	GSR	13	21	28	2	41*	773*	10	13	24,480**
		FO	52 / 65	76 / 97	101 / 129	9 / 11			6	9	
	SHOOTER	FAACS	21	45	60	5			35	47	
		AN/TPQ-37	92	194	259	22			60	80	
		FO SHELREPS	-	30 / 269	40 / 359	3 / 30			4	5 / 153**	

* 41 detections x [illegible] + 35 bytes for header = 773 bytes

** [illegible] messages x [illegible] + 35 bytes for header = 24,480 bytes

FIGURE IV-1. DIVRAS ESTIMATED EXTERNAL MESSAGE INPUT RATES

COMMUNICATION LINE IDENTIFICATION	CATEGORY	SENSOR SOURCE	MANEUVER APPLICATION		TARGETING APPLICATION	
			MESSAGE HEADER (BYTES)	MESSAGE LENGTH (BYTES)	MESSAGE HEADER (BYTES)	MESSAGE LENGTH (BYTES)
QUICK LOOK CPC - DIVRAS	EMITTER RADAR	QUICK LOOK	35	18	35	145
CORPS TARGET TEAM - DIVRAS	SHOOTER/ MOVER	MAGIIC (OV-1)	N.A.	N.A.	35	185
	EMITTER RADIO	GUARDRAIL				
GUARDRAIL CPC - DIVRAS	EMITTER RADIO	GUARDRAIL	35	18	N.A.	N.A.
TEAM PACK CPC - DIVRAS	EMITTER RADAR	TEAM PACK	35	18	35	145
DIVISION ALL SOURCE - DIVRAS	EMITTER RADIO	TRAILBLAZER	N.A.	N.A.	35	185
TRAILBLAZER CPC - DIVRAS	EMITTER RADIO	TRAILBLAZER	35	18	N.A.	N.A.
SOTAS GROUND STATION - DIVRAS	MOVER	SOTAS	N.A.	N.A.	35	125
TACFIRE - DIVRAS	MOVER	GSR FO	35	18	35	125
	SHOOTER	FAALS AN/TPQ-37 FO SHELREPS				

FIGURE IV-2. DIVRAS ESTIMATED EXTERNAL MESSAGE LENGTH